PROPOSAL 276 / COMMERCIAL FISHERY MANAGEMENT IN THE COPPER RIVER DISTRICT

REPORT TO THE ALASKA BOARD OF FISHERIES, ANCHORAGE, ALASKA – JANUARY 9, 2001

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Introduction

The Department of Fish and Game does not have a conservation or management concern over wild sockeye salmon in the Copper River. The past 5 years have not demonstrated that the department is experiencing a chronic inability to manage for and achieve escapement goals. In ranking the total runs of sockeye salmon *Oncorhynchus nerka* to the Copper River since 1966, nine of the top ten runs have occurred during the past 10 years. While these record runs have provided all harvesters the opportunity to enjoy an abundance of salmon in recent years, they have also raised the bar on expectations as to what this river will consistently produce. Following the two largest sockeye salmon runs in 1996 and 1997, annual runs have declined. The Copper River's sockeye salmon forecast suggests that the current declining trend will continue in 2001 (Figure 1).

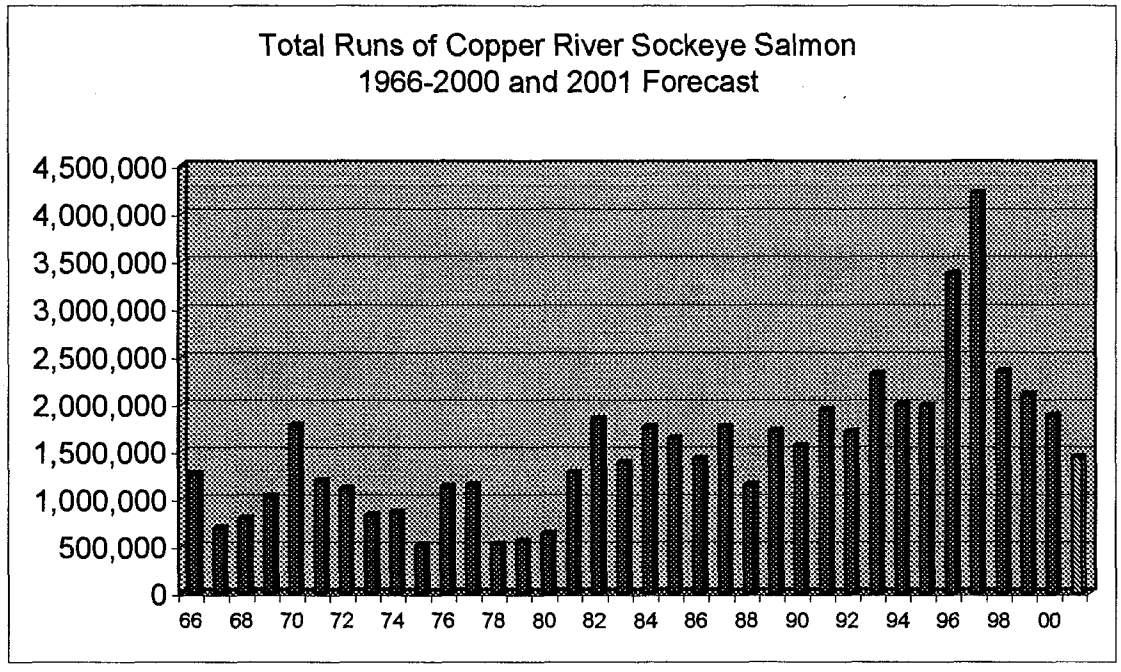


Figure 1. Total sockeye salmon runs to the Copper River, 1966-2000, and the 2001 run forecast.

The Department of Fish and Game, with allocative direction from the Board of Fisheries, has consistently endeavored to manage salmon runs to the Copper River to assure sustained yield and to satisfy all user group allocations, as outlined in 5AAC 24.361 Copper River District Salmon Management Plan. To these ends, the past decade can be measured more by its successes than shortfalls. At the December 1999 meeting in Valdez, the Board of Fisheries amended 5 AAC 24.361, the Copper River Chinook Salmon Fishery Management Plan to provide the department both the tools and the discretion to manage the early season as necessary to maintain the spawning escapement within the range of 28,000 to 55,000 chinook salmon *Oncorhynchus tshawytscha*. This season, the department actively enacted provisions in the plan with positive results.

The current management tools available to the department have allowed it to consistently respond to indices of abundance inseason and to regulate the commercial salmon harvest accordingly. In 2000, the department began reexamining the feasibility of using dipnets

and small mesh gillnets to test-fish in the lower river early in the season for sockeye salmon. Accurately monitoring inriver movement of salmon above the commercial fishing district and below the sonar has long been recognized as a useful tool that could add precision to early season management actions. The department has been pursuing lower Copper River assessment projects since the 1992 season.

Working in the lower Copper River in May has proven to be challenging. The department received new funding to broaden its test-fishing efforts in 2001. Initial test fishing results may be used to confirm that inriver migration has begun, while a long-term goal would be to develop a relationship between test fish indices and subsequent sonar counts. The Native Village of Eyak has also proposed a lower river assessment project that has the potential to further help characterize run entry well below the Miles Lake sonar counters. They are currently seeking federal funding for their project to begin in 2001.

In managing the commercial harvest to provide for upriver escapement and allocations, the department's primary measure of inseason success and the focus of Proposal 276 is the escapement index provided by the Bendix sonar counters at Miles Lake. Upriver subsistence harvests have averaged 196,140 salmon from 1995-1999. An increasing trend in subsistence harvests is reflected annually through additions to the inriver goal. Additionally, aerial escapement indices, coded wire tag data, and weir data have provided supporting information as to the relative success the department has had in meeting provisions of the Copper River District Salmon Management Plan. While the Board has undoubtedly received numerous testimonies by all users regarding the status or importance of these early stocks, achieving biological escapement goals and satisfying other management plan provisions have remained the departments primary management objectives.

Background

The Copper River District commercial fishing season has opened in mid-May since the early 1960s. Fishing periods are now established inseason by emergency order following many years of "book openings" that formerly ran from Monday mornings to Friday evenings. In general, fishing time has steadily been reduced over the years in response to changing patterns in the fishery, increased efficiency of the fleet, and reallocations by the Board of Fisheries. Two commercial fishing periods per week has been the recent pattern with the duration of a given fishing period dependant upon trends in escapement, harvest, and environmental conditions.

The upriver biological escapement goal for wild stock sockeye salmon is 300,000 fish and this number has been constant since being adopted in 1972 and placed into regulation in 1980 (Fried 1994). The Copper River District Salmon Management Plan outlines the biological and allocative categories that comprise the inriver goal for Miles Lake sonar. Spawning escapement, subsistence harvest, sport fishery, hatchery brood, and hatchery surplus are the categories included in the management plan's inriver goal. The relative timing of the wild and enhanced components of the Copper River run is shown in Figure 2. The timing of enhanced fish passing Miles Lake sonar is based on the historical contribution of enhanced sockeye salmon to the commercial harvest adjusted forward to compensate for travel time from the commercial fishing district to Miles Lake.

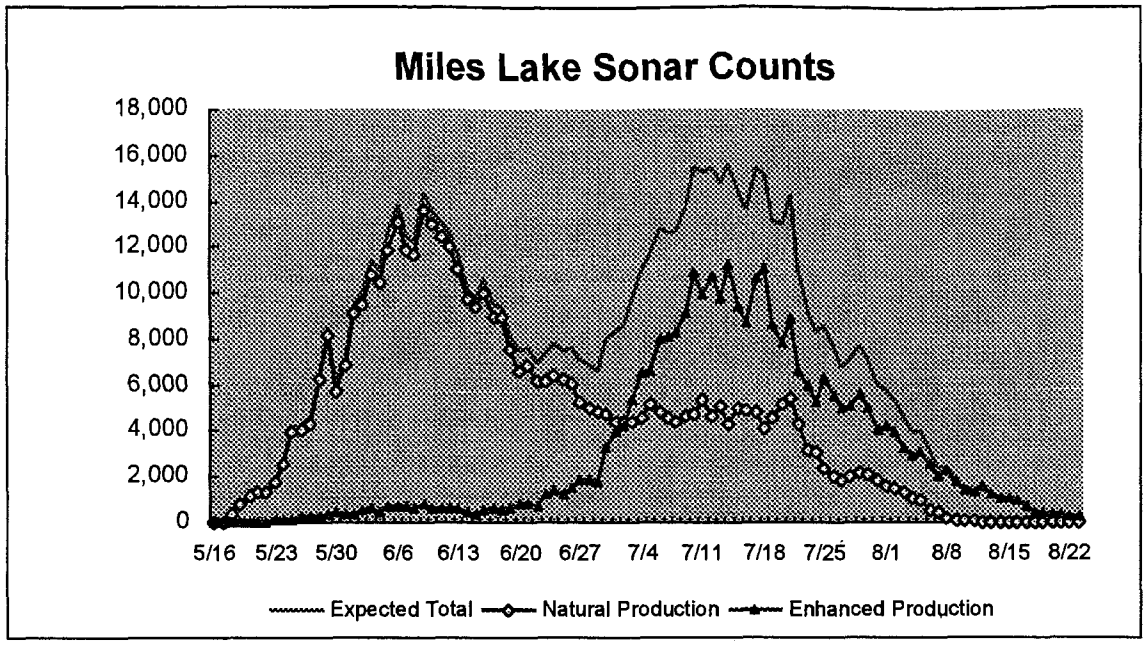


Figure 2. Relative timing of natural and enhanced sockeye salmon production, 2000.

Of the five categories contained within the inriver goal, the most significant increases over time have been in the hatchery surplus and subsistence categories. In the early 1980s, the inriver goal stood at 516,000 salmon. By 2000, the inriver goal totaled approximately 768,000 wild and enhanced salmon. In 2000, based upon the forecasted run of some 850,000 enhanced sockeye salmon to the Copper River, the hatchery surplus within the inriver goal was set at 230,500 sockeye salmon. The other inriver goal categories included 185,000 subsistence, 15,000 sport, 17,500 "other salmon" and 20,000 hatchery broodstock sockeye salmon for a total inriver goal of 768,000 salmon. The escapement objective for the Miles Lake sonar counter called for 739,145 salmon to pass the counter by August 3, the last scheduled day of counting for the sonar project.

The category of subsistence salmon within the inriver goal is expressed as a range. The number of fish added to the inriver goal for subsistence use is set annually based on the harvest in recent years. In 2000, the upper end of the Glennallen Subdistrict harvest range and the mid-point of the Chitina Subdistrict harvest range were combined and incorporated into the inriver goal. The number of surplus sockeye salmon within the inriver goal is determined annually based on the Gulkana Hatchery run forecast and a preseason estimate of the commercial harvest exploitation rate that wild stocks can likely sustain during the late June and July mixed stock fishery in the Copper River District. It is important to note that these surplus salmon do not fulfill any biological escapement needs, nor are they specifically linked to any upriver subsistence harvest or sport allocations. An unknown percentage of the substantial hatchery surplus is taken during July and August in these upriver fisheries.

2000 Early Season Summary

The first commercial fishing period occurred on Monday, May 15. The first period was for 12 hours and included a central statistical area closure inside the barrier islands as stipulated in the chinook salmon management plan. The closure prohibits fishing inside

the barrier islands in the center of the Copper River District. The chinook salmon harvest of 5,875 was less than anticipated while the sockeye salmon harvest of 38,851 slightly exceeded the predicted semi-weekly harvest of 35,477 fish (Appendix 1). Anecdotal reports consistently indicated that there were few sockeye salmon caught inside the barrier islands at the period's opening. Many harvesters concentrated their efforts in those limited open areas inside the barrier islands during the initial low water to target chinook salmon. Once chinook salmon catches tapered off, most of the fleet fished outside the barrier islands where a majority of the sockeye salmon harvest occurred during the first period.

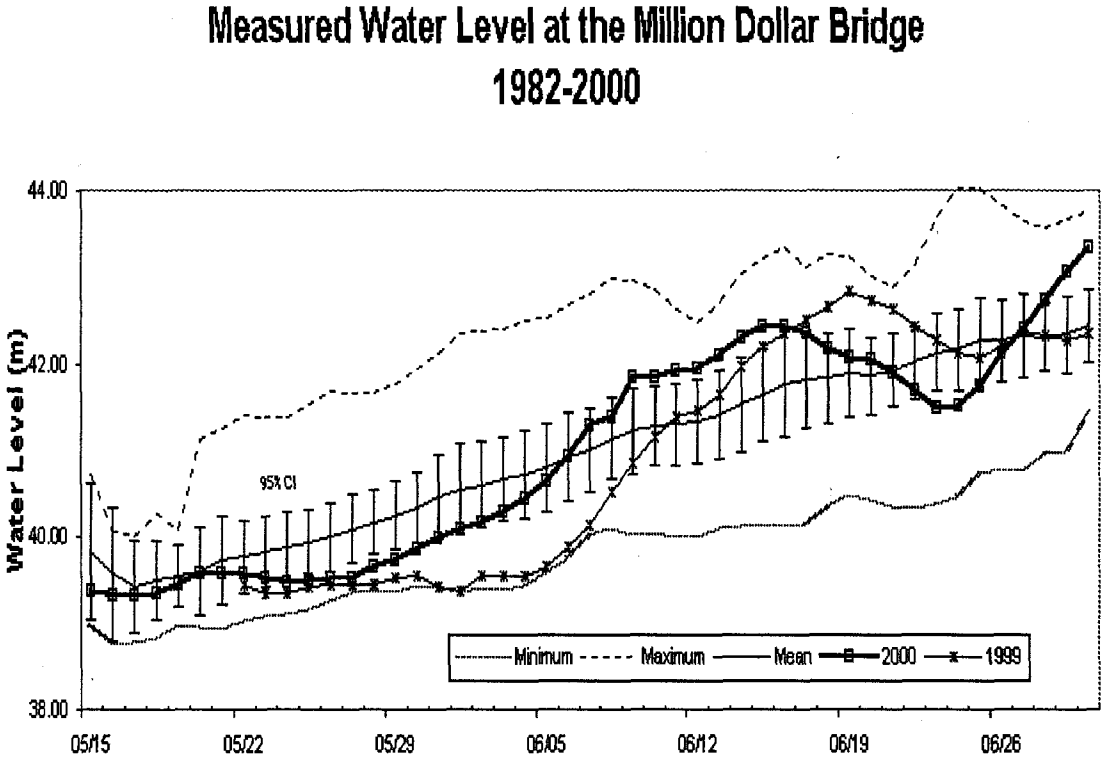


Figure 3. Measured water level at the Million Dollar Bridge, 1982-2000.

With water levels remaining below average (Figure 3), the second fishing period on May 19 was again limited to 12 hours, and the inside statistical area again remained closed. The harvest pattern was similar to the first period's: following initial effort directed towards chinook salmon, many boats moved outside to target sockeye salmon. The chinook harvest of 5,564 was roughly half the anticipated while the sockeye harvest of 85,602 was approximately 40,000 fish higher than anticipated (Appendix 2). Sockeye salmon catches were reported to have improved slightly inside the barrier islands for the second period, but most reports indicated that a majority of the sockeye salmon harvest was caught outside the islands. Indications from the commercial harvest were that chinook were entering the Copper River while inriver sockeye salmon migrations had not begun in earnest.

The south-bank sonar counter at Miles Lake began counting on May 18, and initial counts indicated that few salmon were passing the sonar counter (Appendix 3). The north bank counter did not begin counting until May 29 when iceberg conditions and water levels had improved. During initial low flows, salmon below Miles Lake appeared to be much less south-bank oriented than they are later in the season at higher water levels. Initial counts were higher than normal on the north bank in 2000.

The third opening on May 22 was again for 12-hours, but the inside statistical area was opened for the first time. The chinook salmon harvest increased to 7,278 fish and the sockeye salmon harvest declined to 68,603 fish. Reports from the fishing grounds indicated that sockeye salmon were plentiful inside the barrier islands for the first time this season indicating greater upriver movement. The fourth period, scheduled for May 26, was cancelled to take advantage of what appeared to be the first significant push of sockeye salmon to enter the river. Daily salmon passage improved and exceeded the anticipated daily passage beginning May 27 (Appendix 4).

Because of the sonar deficit at the time and reports from the fishing grounds that the sockeye salmon run did not appear to be as large as in past years, the next fishing period was limited to 6 hours centered around high tide. Limiting the opening to bracket the high tide would reduce the harvest potential of the inside fishery while supplying needed information on run entry strength following the previously cancelled fishing period. It would also reduce the fleet efficiency by not providing much time for a majority of the fleet to travel and prospect for fish concentrations in the ocean. The harvest of 80,820 sockeye and 4,070 chinook salmon in a 6 hour period on May 29 occurred during what is traditionally the peak early season harvest period for sockeye salmon.

Sonar passage on May 29 was 9,864 salmon versus an anticipated passage of 6,173 salmon. Counts improved on May 30 to 12,452 salmon versus an anticipated count of 7,275 salmon. With daily sonar passage exceeding the anticipated passage, a 12-hour period was scheduled for June 1. On June 1, the actual cumulative sonar count past Miles Lake stood at 53,820 salmon versus an anticipated cumulative count of 70,774 salmon, a deficit of 16,956 salmon. The period was again kept short in deference to the sonar deficit, even as the current daily passage rate was exceeding the anticipated passage.

The June 1 harvest was 78,888 sockeye salmon compared to an anticipated semiweekly harvest of 96,622 fish. The fleet size in the Copper River District stood at 439 boats on June 1, a reduction of 60 permits from the May 29 period as boats departed for the Coghill District to target enhanced chum salmon at Wally Noerenberg Hatchery. Another 12-hour period on June 5 resulted in a harvest of 46,023 reds versus an anticipated harvest of 65,441 sockeye salmon. Daily sonar passage rates that had shown steady improvement in late-May and early June began to fall behind the daily anticipated counts beginning June 4 and the decision was made to close the fishery following the June 5 fishing period. The fishery remained closed from June 6 until June 23, resulting in the cancellation of four traditional fishing periods. The sonar responded to the extended closure, although not as robustly as in the recent years when stronger runs could pulse large numbers of salmon into the river during a closure.

On June 29, 2000, the anticipated and actual cumulative sonar counts were at approximately 350,000 salmon. By the first week in July, the number of enhanced fish passing the sonar is generally greater than the number of wild fish. Most of the fish passing the sonar during the May-June window can be assumed to be wild stocks. Coded wire tag data from the June 5 fishing period indicated that 99% of the sockeye salmon harvested were of wild stock or Paxson Lake origin. When fishing resumed on June 23, enhanced sockeye salmon contributed between 40% and 60% of the harvest. The enhanced contributions to the commercial harvest were highest, > 75%, during the July 3 fishing period.

Summary of commercial fisheries management actions taken in 1999 and 2000:

1999

-Inside Closure first period.
-First 4 fishing periods limited to 12 hours.
-Cancellation of two consecutive fishing periods in early June.

2000

-Inside closure first two periods
-First three periods limited to 12 hours.
-Fourth period cancelled.
-Fifth period limited to 6 hours at high water.
-Sixth and seventh periods limited to 12 hours.
-Cancellation of next four consecutive fishing periods in early June.
-Twelfth fishing period limited to 12 hours.

Aerial Surveys and Weirs

If the daily inriver sonar goal is being reasonably met over time, an acceptable escapement distribution is assumed to also be a result. In general terms, a goal of having approximately 350,000 predominantly wild sockeye salmon past Miles Lake sonar by the end of June was met in 2000. Whether the timing of these 350,000 fish, following upriver subsistence harvests, produced an optimum escapement distribution is difficult to quantify. The aerial survey program that ended in 1993 admirably documented upper Copper River sockeye salmon spawning distribution, timing, and relative abundance; and is still the standard for making general comparisons. Appendix 5 shows the peak sockeye salmon aerial survey counts for 2000 and compares them to the 1983 through 1992 averages. The early timed spawning systems, identified as those streams with optimal survey dates beginning in mid to late July, are shaded.

Upper Copper River aerial surveys in 2000 were funded by Commercial Fisheries Division and flown by Sport Fish Division personnel based in Glennallen. As time allowed, two or three surveys were flown on a selection of index streams between August 5 and September 5. This level of surveying was less than was used to construct the 1983 to 1992 average, but was still the most comprehensive survey effort in recent years. The results can be used to characterize the relative distribution of sockeye salmon on the survey dates. In general, wild stocks were distributed throughout the drainage with a few systems appearing to exceed the 1983-92 average and some falling short. The narrow timing window in which surveys were conducted was unlikely to capture peak counts at all spawning systems but was chosen to cover a cross section of upriver sockeye salmon

spawning areas. The optimum survey dates for Keg Creek all occur in July before surveys began in 2000. While no live sockeye salmon were counted during three surveys of Dickey Lake, salmon carcasses were seen. The observed distribution appeared to cover both early and late timed stocks.

Salmon weirs have been operated at Tanada Creek, an early and mid-timed sockeye salmon spawning system central to the Batzulnetas subsistence harvest; at Long Lake, a late-timed sockeye salmon spawning system near McCarthy; and at Crosswind Lake where enhanced sockeye salmon return. The Tanada Creek weir, operated by the National Park Service, was in place in 1997 and 1998, but not in 1999. High water forced the early removal of the weir in 2000. Park personnel flying aerial surveys counted 1,350 sockeye salmon in 2000 and 5,560 reds in 1999. Unassociated aerial surveys flown by department personnel estimated 3,200 salmon in 2000 and 350 in 1999. The Tanada weir count in 1998 was 28,992 sockeye salmon while the peak aerial count by park personnel was 4,470 reds. In 1997, the weir count was 27,521 while the peak aerial count was 7,875.

The Long Lake weir enumerates late-timed salmon and is operated by the generous volunteer efforts of Mr. Cliff Collins of Long Lake and his family. His weir count in 1999 was 12,919 sockeye salmon by October 1, approximately 2,500 below the recent ten-year average. In 2000, the Long Lake weir count in mid-September was 8,445 reds with an estimated 1,000 more below the weir when it was removed due to high water. In 2000, the Crosswind Lake weir counted 62,881 hatchery surplus sockeye salmon that escaped commercial and subsistence fisheries downstream. The 2000 Crosswind Lake surplus is approximately 35% less than in recent years and yet, stands in sharp contrast to the broodstock shortfall experienced at Gulkana Hatchery where no surplus was available.

Early Season Exploitation Rate Estimation

When the commercial fishery in the Copper River District begins in mid-May, a majority of the harvest is comprised of upriver wild stocks with additional contributions coming from upriver enhanced, and early wild stocks originating from the Copper River Delta. Run timing for any given stock is assumed to follow a bell-shaped distribution. To distribute the harvest and escapement over time, the management strategy has been to pulse the commercial harvest using the best inseason information available. Pulsing the harvest will only produce an acceptable result upriver if adequate inriver migrations are occurring simultaneously.

The early season Copper River commercial fishery has been inaccurately described as a cleanup fishery that occurs twice weekly inside the barrier islands at the mouth of the river. This image creates a misconception that a sockeye salmon caught in the district on Monday would have contributed to Tuesday or Wednesday's escapement had it not been caught. In reality, a significant portion of the sockeye salmon harvest occurs in the open ocean away from beaches or the barrier islands. While an individual stock's travel time through the commercial fishing district will vary for biological or environmental conditions, after May 15 an individual salmon may be exposed to more than a single commercial fishing period depending upon its pace through the Copper River District.

The Copper River sockeye salmon fisheries, like most Alaska salmon fisheries, are managed for constant escapement goals rather than constant exploitation rates (Eggers 1993). This results in variable harvests and exploitation rates depending on the run size, e.g., when the run size is large compared to the escapement goal, the harvest and exploitation rate will increase.

The exploitation rates on upriver sockeye salmon by statistical week (Appendix 6; Appendix 7) were estimated using (i) commercial gillnet harvests by statistical week, (ii) Miles Lake sonar counts lagged to match commercial harvest timing, and (iii) the average proportion of upriver sockeye salmon in commercial harvests determined from scale patterns analysis studies conducted from 1982 to 1987 (Sharr 1983; Sharr et al. 1984; Sharr and Goshert 1985). These data provide a very rough approximation of the exploitation rate on upriver stocks because of the variability in each data set and the assumptions of the analysis.

An accurate estimate of the exploitation or harvest rate applied to a stock requires temporally stratified, stock specific harvest and escapement data. These data are difficult and expensive to collect for specific stocks or even stock groups, e.g., upriver and delta sockeye salmon stock groups. The upper Copper River and Copper River delta sockeye salmon stock groups are considered "stocks" in the calculation of biological escapement goals because each group is managed as a unit (Fried 1994; Geiger and Gharrett 1997).

In creating exploitation rate estimates, it is important to consider the assumptions and variability of each data set separately, starting with the commercial harvest data. The commercial harvests as reported on fish tickets are assumed to be an accurate representation of the harvest numbers. However, the Copper River commercial fishery is not strictly a terminal harvest fishery. Fish harvested inside the barrier islands may have been four days away from the sonar while fish harvested further out in the district may have been ten days away from the sonar. Because fish are a variable number of days away from the measure of escapement, estimates of exploitation rate based on a fixed migration time are biased.

The Miles Lake sonar provides an index to the abundance of salmon in the Copper River. The sonar enumerates an unknown number of the total escapement and is likely biased low due to the transducer dead range and beam angle. Early in the season, frequent transducer adjustments are necessary due to ice, fluctuating water levels, and waves from strong winds (Morstad 1999). All of these adjustments reduce counting time. At lower river levels, a larger proportion of the salmon migrate along the North bank, and the distribution within the river is not as bank-oriented as at higher water levels (Brady 1986). All of these factors tend to reduce the escapement index and inflate the exploitation rate estimate.

The Miles Lake sonar site, approximately 50-km upriver from the commercial fishing district, is the first useable location where the river is in one channel. The migration time between the commercial fishing district and the Miles Lake sonar site has been estimated at three to ten days (Roberson et al. 1980; Shaller et al. 1984) and likely varies with river conditions. However, these estimates are based on comparisons of commercial harvest and sonar data; no estimates from mark recapture studies are available. The number of days the

sonar counts are lagged to match the commercial harvests has a large effect on the estimates of exploitation rate (See Appendix 6 and Appendix 7).

Scale patterns analysis studies demonstrated that the upriver component of the commercial harvest was highly variable (Marshall et al. 1987). For example, the proportion of upriver fish in statistical week 21 ranged from 0.57 in 1982 to 0.99 in 1985 (Sharr 1983; ADF&G unpublished data). The 90% confidence intervals around the proportion estimates were also large, e.g., for upriver sockeye salmon aged 1.3 in 1982, the estimated proportion was 0.57 ± 0.25 (Sharr et al. 1984). This indicates that using the average upriver proportion may introduce a large amount of error to exploitation rate estimates.

The discussed factors (i) accurate estimate of harvest (ii) variable number of days from harvests in the commercial fishing district to Miles Lake sonar, (iii) sonar escapement index of unknown accuracy and likely biased low; (iv) unknown relationship between river conditions and migration time to the Miles Lake sonar site, (v) large variability among years in the estimates of the proportion of upriver sockeye in the commercial harvests, and (vi) 90% confidence intervals around the proportion estimates within years of up to ± 0.25, when considered in combination make it difficult to place much weight in calculated exploitation rates.

Given the assumptions listed above, a six-day lag produces average exploitation rates for 1990-2000 ranging from 0.73 in statistical weeks 20 and 21 combined to 0.45 in statistical week 24 (Appendix 6). Note that the mean exploitation rate for statistical weeks 20 and 21 combined is biased high because for several years there are harvests without completely paired escapements due to river conditions that limited use of the sonar gear. The mean exploitation rate by year for statistical weeks 20-25 ranged from 0.49 in 2000 to 0.68 in 1997. This corresponds to the lowest estimated run size (2000) and the highest estimated run size (1997) for statistical weeks 20-25. Exploitation rates for Cook Inlet sockeye salmon stocks calculated with similar methods ranged from 0.52 in 1979 to 0.82 in 1988 (Mundy et al. 1993).

Proposal 276 Problem Statement

Proposal 276 is seeking to allow 100,000 salmon to pass the Miles Lake sonar prior to the initiation of commercial harvesting. The proposal is based on the contention that early timed escapement goals for sockeye and king salmon are consistently not being met due to overharvesting by the commercial drift gillnet fleet. Given that no additional conservation measures for upriver harvesters are contained in the proposal, it is primarily viewed as a significant reallocation that eliminates the commercial harvest opportunity on a majority of the Copper River's chinook salmon run and the most valuable portion of the Copper River's sockeye salmon run. Statements made in support of the proposal are that early escapement goals have been met only once in the past 21 years. For the years 1990-2000, Figure 4 and Figure 5 show the differences between the anticipated and actual sonar counts at Miles Lake on May 31 and June 15 respectively. Figure 4 shows that on May 31, the inriver goal measured at Miles Lake sonar was being met or significantly exceeded in 5 of the 11 years displayed. Figure 5 shows that by June 15, the goal was being met or greatly exceeded in 6 of the 11 years shown.

Since the sonar project began, anticipated Miles Lake sonar counts and the BEG have never been expressed as a target range. Managers use the points along the escapement curve as a target, recognizing however that high sustained yield will be maintained within some range above and below the target timing curve. It must therefore be stressed that the Figures 4 and 5 capture the status of cumulative counts on a single day, when in fact each day is characterized by dynamic daily and hourly changes in sonar passage rates. For example, in Figure 5 the June 15 deficits in 1991 and 1994 of 22,276 and 9,968 fish could be viewed, when examining the daily passage rates for those years, as respectively being less than 36 and 20 hours behind the anticipated counts for that day. The magnitude of some deficits on any given day should always be considered in context for that year.

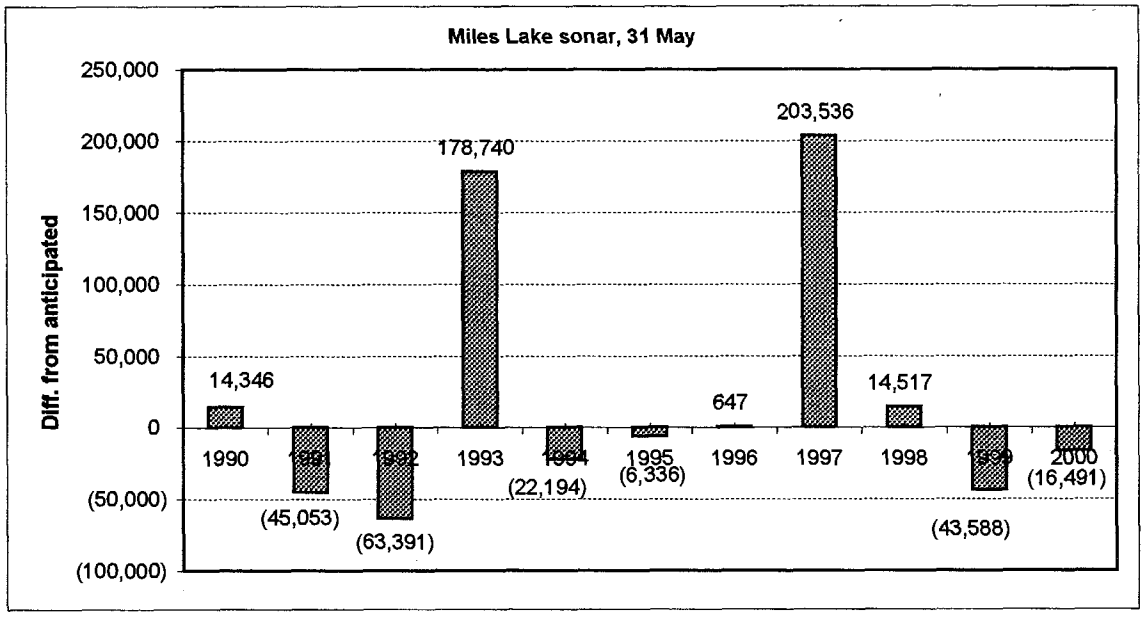


Figure 4. Differences between actual sonar counts and anticipated counts at Miles Lake on May 31 for the years 1990 – 2000.

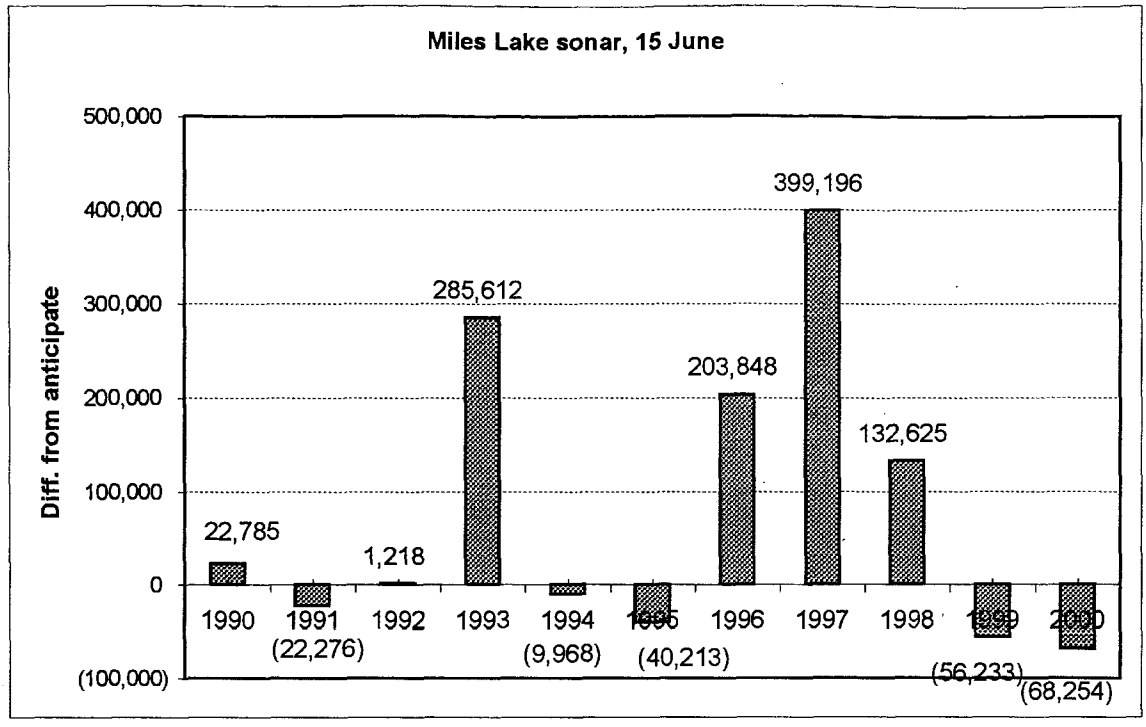
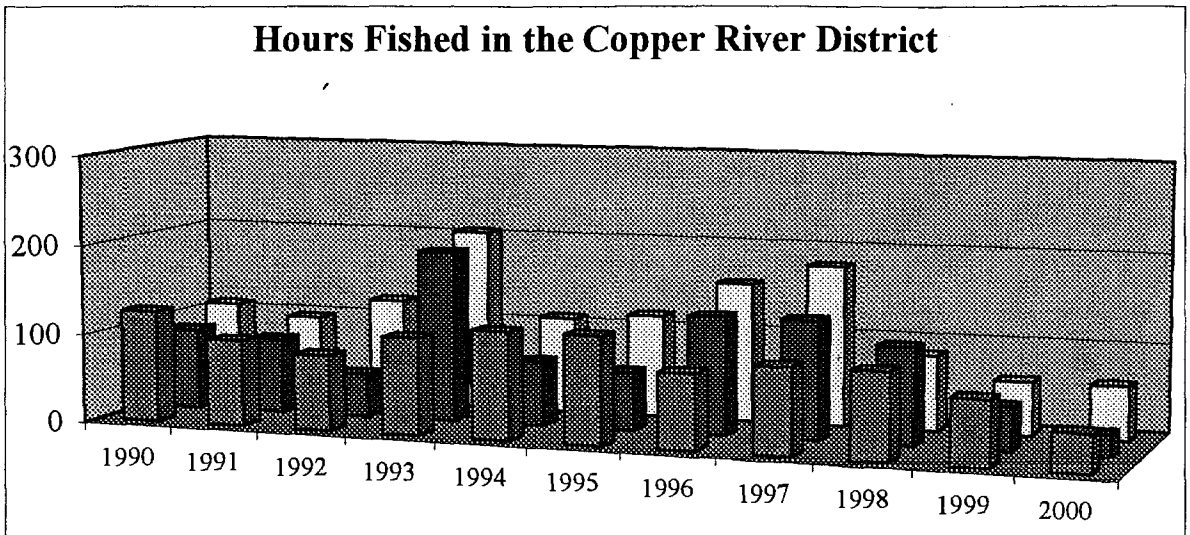


Figure 5. Differences between actual sonar counts and anticipated counts at Miles Lake on June 15 for the years 1990 – 2000.

Corresponding to the sequence of sonar surpluses and deficits displayed above, Figure 6 depicts the fishing time that managers have provided the drift gillnet fleet early in the season from 1990-2000. Figure 6 demonstrates that in years when early sonar counts are trailing the anticipated counts, less fishing time is provided and, in years with large surpluses, fishing time still remains limited. With the exception of 1997, a schedule of two periods per week or less has been maintained in order to distribute the harvest and escapement over time. Figure 6 also clearly shows that for the 1999 and 2000 seasons, early season fishing time was the least amount of time given to the drift gillnet fleet over the past decade. The commercial fishing has not been similarly restricted since the 1979 and 1980 when preseason forecasts indicated that sockeye salmon escapement shortfalls were likely to occur even in the absence of a commercial fishery. At that time, the fleet was severely restricted in time and gear was limited to large mesh gillnets to selectively target king salmon and avoid sockeye salmon.

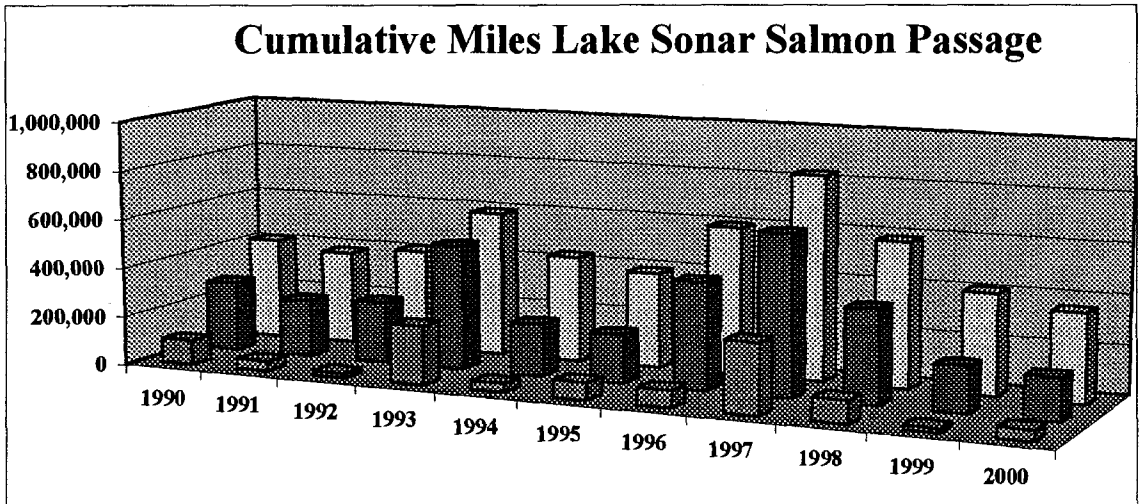
Proposal 276 suggests that steps must be taken now to begin to rebuild the early portion of the sockeye salmon run. Parent year escapements in 1996-1998 for the coming 2001–2003 return years all exhibited strong early season escapement past the sonar counters and exceeded the inriver goal early. In 1999 and 2000, sonar counts trailed the anticipated counts until late June. To mitigate any reduction in Maximum Sustained Yield potentially caused by the early season sonar deficits of 1999 and 2000, the department should focus on employing a cautious early season management strategy in 2003-2005. An opportunity to provide timely direction to the department will be available during the 2002 Board of Fisheries meeting. Two additional years of test fishing information will likely be available then to help evaluate early season management options.

On average 105,000 salmon have passed the sonar by June 1 for the years 1990-2000 (Appendix 8). These are years with the commercial fishing season beginning in mid-May and the runs actively managed based on inseason abundance. Cumulative sonar passage for these same years is also shown in Figure 7 while the cumulative commercial harvest for the same time frame is shown in Figure 8.



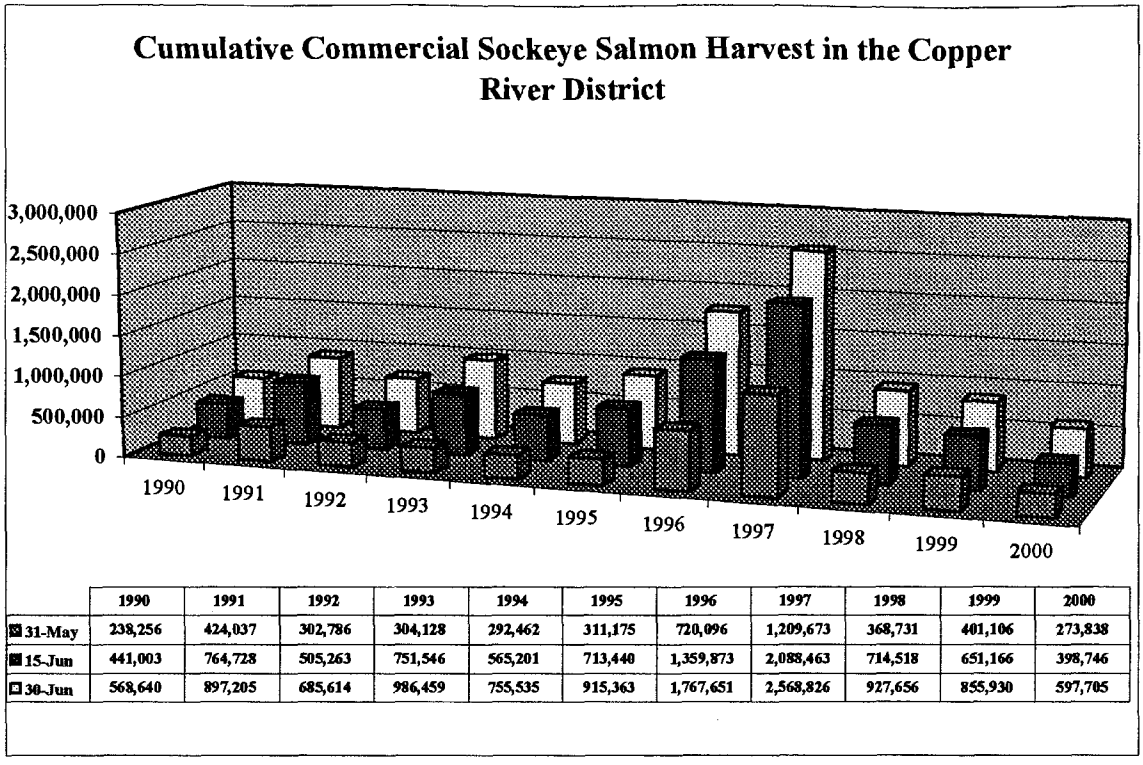
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
May 1-31	125	96	84	108	120	120	84	96	96	72	42
June 1-15	91	84	48	192	72	65	132	132	108	48	24
June16-30	108	96	120	204	108	115	156	180	84	60	60

Figure 6. Hours of commercial fishing in the Copper River District, 1990-2000.



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
31-May	99,288	39,744	18,686	237,200	36,265	68,717	68,807	280,850	91,679	16,661	43,463
15-Jun	283,543	232,656	250,487	507,744	212,163	196,006	432,197	645,527	378,004	183,605	169,230
30-Jun	414,846	382,048	410,373	591,427	430,327	387,474	597,021	825,954	584,265	406,871	355,867

Figure 7. Cumulative Miles Lake Sonar Salmon Passage, 1990-2000.



	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
31-May	238,256	424,037	302,786	304,128	292,462	311,175	720,096	1,209,673	368,731	401,106	273,838
15-Jun	441,003	764,728	505,263	751,546	565,201	713,440	1,359,873	2,088,463	714,518	651,166	398,746
30-Jun	568,640	897,205	685,614	986,459	755,535	915,363	1,767,651	2,568,826	927,656	855,930	597,705

Figure 8. Cumulative commercial sockeye salmon harvest in the Copper River District, 1990-2000.

Consequences of a Sonar Trigger for the Commercial Fishery

There is a long-standing, successful history of initiating harvesting in mid-May in the Copper River District and subsequently responding inseason to indices of abundance in order to satisfy the inriver goal and still harvest surpluses. The location of the Miles Lake sonar counters is approximately 50 km above the commercial fishing district (Appendix 9). Because of its unique status of being the first major salmon run to Alaska waters, the conditions Copper River salmon encounter in May can be highly variable from year to year. Tides, river discharge levels, or temperatures encountered may positively or negatively influence run entry and inriver travel time in any given week. Salmon may receive a significant boost upstream by large tides or early breakup conditions; they may migrate more slowly during high flood conditions; or they may hesitate to enter the river when extremely low water or thermal barriers are encountered. The Board of Fisheries recognized that these variable circumstances sometimes exist and adopted a management plan for the department to actively manage the chinook salmon fishery accordingly.

Weather conditions in May also influence when the sonar counters can be installed at Miles Lake. Counters have been made operational anywhere from May 15 to May 27 during the past 11 years. Recently, the department has relied upon the voluntary efforts of the U.S. Coast Guard to transport the crew and counters to Miles Lake, usually around May 10, prior to breakup. The Copper River Highway can remain closed into June due to the substantial annual snow pack. The initial anticipated sonar counts in mid-May are less than 1,000 fish per day. Given a May 15 opening date and a 6 to 9 day migration time, salmon passing the counter prior in mid-May can be assumed to have entered the river prior to the

onset of commercial harvesting. By late-May, salmon that pass the counter are likely to have been exposed to some harvest pressure in the Copper River District if a two periods per week schedule is maintained.

In 1993, unexploited salmon migrating upriver at the start of the season produced daily counts as high as 32,000 fish per day, nearly ten times higher than the actual daily objective. Because of the favorable early season conditions and an early breakup, inriver salmon migration was fast and strong. By May 31, 1993, the inriver sonar goal was being exceeded by approximately 179,000 salmon which represented a lost opportunity for the commercial gillnet fleet and created a surplus that greatly exceeded the upriver harvest potential. Awaiting any trigger point, much less a sonar goal of 100,000 salmon has a similar potential to allow hundreds of thousands of surplus sockeye and chinook salmon to needlessly escape the fishery.

In 5AAC 01.647 Copper River Subsistence Salmon Fisheries Management Plan, the Board of Fisheries affirmed their intention to link management of the Chitina Subdistrict subsistence dipnet fishery to actual sonar counts, similar to commercial fishery management. As is provided for in current regulation, both fisheries experienced reduced early season fishing time as a result of lower than anticipated escapement in 1999 and 2000. Under 5AAC01.630 (f) (7) (C), the dipnet fishery was later given opportunities to harvest additional fish in both 1999 and 2000. The Glennallen Subdistrict subsistence fishery, immediately upstream from the Chitina Subdistrict, began its season on June 1 as provided for in regulation and was able to provide early subsistence salmon harvest opportunity. Federal regulations have advanced the June 1 opening date to May 15 for the 2001 season.

In mid to late June, sockeye salmon escapement into delta spawning systems becomes the primary consideration in determining fishing time in the Copper River District. The importance the department has placed in attaining the delta's wild stock escapement is evidenced by the significant hatchery surpluses built into the inriver goal the past few years. As previously stated these surpluses are placed in the inriver goal to minimize the harvest pressure on upriver and delta wild stocks. Their inclusion in the inriver goal presumes an ongoing controlled harvest targeting late timed wild and enhanced stocks throughout late June and July. In both 1999 and 2000, extended closures and conservative management actions in June resulted in the sockeye salmon escapement goal being reached or exceeded early in both years in the lower river systems. This reduced the need in both seasons to provide large surpluses of sockeye salmon upriver. Nevertheless, the inriver goal was exceeded during July in 1999 despite an aggressive commercial fishing schedule.

The enhanced run in 2000 was clearly performing below the preseason forecast of 850,000 fish. Fishing hours were reduced from the previous season. It became clear that fulfilling an inriver goal of 235,000 surplus salmon with a run that appeared to be half its forecasted strength would require a majority of any available surplus be passed upriver unharvested. Since delta spawning escapements were already on track early in the season, the department did not attempt to fully satisfy the hatchery surplus goal in July. Based on post-season hind casting, an accurate inriver sonar goal for 2000 would have been set closer to 606,000 by reducing the hatchery surplus category (Appendix 10).

Being a long-term average, the calculated daily sonar goal is relatively static in time. However, the timing of actual salmon runs each year are influenced by a number of factors. As previously stated, tides, discharge levels, or thermal barriers may influence travel time in any given week or season. Meaningful sonar counts early in the season can be sporadic due to glacial and shore ice. Appendix 11 provides a time series of actual and anticipated sonar counts, graphed by day, for the years 1985 to 2000. When reviewing these sonar counts, one comparison is the alignment of the anticipated and actual peak counts in June. These graphs demonstrate some of the variability in the early season timing where runs often appear either advanced or delayed when compared to the average. These graphs do not indicate the department has ever shown a chronic inability to attain escapement throughout any component of the run.

Front-end loading the upriver escapement, as Proposal 276 suggests, will not alleviate the department's obligation to manage for lower river wild stock escapements in June and July or automatically allow for increased exploitation of enhanced stocks. If delta escapement goals are not being met, fishing time is restricted in late June and July, regardless of the level of surplus salmon passing the sonar. This occurred in 1998 when fishing time in late June was restricted despite a significant surplus of salmon having passed Miles Lake sonar. However, when escapement goals are being met in the Copper River Delta, such as occurred in 1999 and 2000, increased fishing time in July may result.

Summary

The Board of Fisheries is next scheduled to address Copper River issues following the 2002 season. The department's actions in managing the commercial fishery the past two seasons should clearly project the department's intent to satisfy the provisions of the Copper River District Salmon Management Plan. The conservative management applied to the commercial fishery in 1999 and 2000 deviated from the recent pattern of early season management in the Copper River District. Conservative measures were employed inseason in response to abundance indices and environmental conditions. Whereas 1999 saw anomalous low water conditions with an overall strong sockeye salmon run, 2000 saw similar low water conditions early on, combined with a run much weaker than forecast. In both seasons, the department responded appropriately to the environmental conditions exercising sound biological judgment for maintaining healthy sustainable salmon stocks.

Early in the season, the Copper River District is managed primarily upon the escapement index past Miles Lake sonar. The uncertainty that is created because of the distance and timing between the commercial fishing district and the sonar counter is central to the concerns expressed by the upriver users that authored Proposal 276. It is also central to the concerns of commercial users at the mouth. Over harvesting when too few salmon have entered the river or under harvesting when there are already too many salmon in the river are potential consequences that impact all users. In fact, both extremes have already occurred in the past decade making the concerns of both sides valid. Consequently, the correct management prescription for any given season may vary dramatically, depending upon that seasons circumstances and the best inseason data available. The strength of the department's inseason management is in its ability to recognize and respond to changing circumstances and new information. While efforts are always being undertaken to improve upon the quality and sources of information, Proposal 276 would limit the

department's ability to respond. Test-fish data may help confirm that early timed sockeye salmon stocks are migrating and allow surpluses to be reasonably exploited. Beginning in 2003, returning hatchery sockeye salmon will be otolith marked which will help in characterizing the enhanced runs and refining management. The management approach suggested by Proposal 276 is primarily allocative and the contention of a long-standing problem is not substantiated by available data. Adopting a sockeye salmon sonar trigger would be a substantial deviation from the current inseason management. Proposal 276 does not clearly address a conservation purpose, reason, or need in the eyes of the department and its adoption would be highly allocative.

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Appendix

Appendix 1. Copper River District commercial drift gillnet salmon harvest by period, 2000.

					Chinook		Sockeye		Coho		Pink		Chum	
Period	Date	Hours	Permits	Landings	Numbers	Pounds	Numbers	Pounds	Numbers	Pounds	Numbers	Pounds	Numbers	Pounds
01[a]	05/15	12	480	536	5,875	119,713	38,851	232,095	2	12	0	0	25	220
02[a]	05/19	12	494	624	5,564	115,548	85,602	505,780	12	92	0	0	156	1,193
03	05/22	12	472	599	7,278	151,459	68,603	405,315	0	0	0	0	37	313
04	05/29	6	499	532	4,070	88,469	80,782	487,874	1	10	0	0	25	209
05	06/01	12	495	618	4,279	94,249	78,888	479,522	0	0	0	0	92	755
06	06/05	12	439	515	1,788	40,030	46,023	286,433	0	0	0	0	84	700
07	06/23	12	299	368	1,213	24,781	80,052	519,852	7	63	3	12	120	900
08	06/26-06/27	24	320	455	364	8,494	62,063	409,256	31	213	468	1,763	1,232	9,487
09	06/29-06/30	24	267	354	215	4,595	56,841	374,041	17	119	282	980	577	4,362
10	07/03-07/04	36	226	439	224	4,946	88,486	603,353	52	348	34	93	141	1,201
11	07/06-07/08	36	244	463	149	3,146	55,608	376,595	433	3,252	893	3,382	1,073	8,534
12	07/10-07-12	36	269	514	120	2,675	54,672	370,520	376	2,930	808	2,859	640	5,128
13	07/13-07/15	36	264	445	69	1,313	43,132	297,813	969	7,161	989	4,059	451	3,637
14	07/17-07/18	36	203	304	27	520	25,691	170,927	984	7,145	1,218	4,524	411	3,244
15	07/20-07/21	24	99	114	5	76	6,948	45,301	486	3,146	462	1,689	133	1,085
16	07/24	12	98	100	2	11	3,068	19,689	1,247	9,129	438	1,564	62	522
17	07/28	12	34	36	3	47	934	5,677	559	3,841	226	764	8	67
18	07/31	12	34	36	0	0	872	5,466	1,436	10,422	759	2,559	5	35
19	08/04	12	42	44	0	0	493	3,248	2,353	17,507	457	1,667	27	219
20	08/07-08/08	24	122	147	5	102	1,380	9,236	11,833	99,350	2,485	9,034	56	443
21	08/14-08/15	24	204	320	2	46	705	4,560	33,293	309,909	236	796	3	26
22	08/21-0822	36	269	606	5	132	477	3,052	87,042	853,333	4	13	4	23
23	08/28-08/29	36	293	659	2	49	136	878	79,659	785,359	42	144	1	8
24	09/04-09/05	36	274	427	0	0	24	147	40,725	405,603	0	0	0	0
25	09/11-09/12	36	142	264	0	0	2	14	25,215	250,760	0	0	0	0
26	09/18-09/19	36	89	145	0	0	0	0	13,584	136,329	0	0	0	0
27	09/25-09/26	36	52	65	0	0	0	0	4,590	47,003	0	0	0	0
28	10/02-10/03	36	1	1	0	0	1	8	38	387	0	0	0	0
Total			525	9,728	31,259	660,401	880,334	5,616,652	304,944	2,953,423	9,804	35,902	5,363	42,311
Average Weight						21.13		6.38		9.69		3.66		7.89

[a] Waters inside the barrier islands from the west side of Pete Dahl entrance to the east side of Kokenhenik were closed.

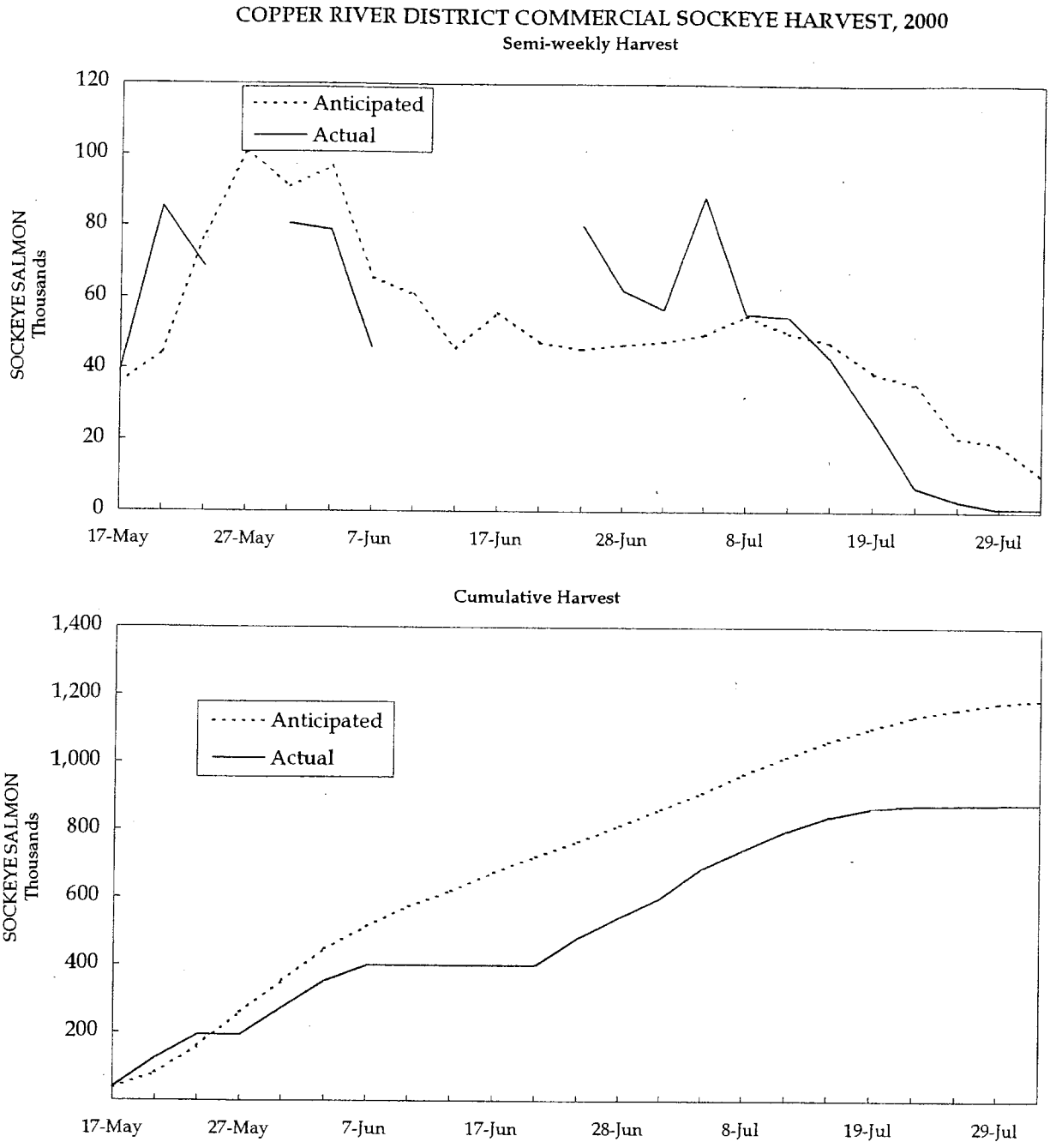
Appendix 2. Anticipated and actual weekly catch and escapement of sockeye salmon in the Copper River District drift gillnet fishery, 2000.

Semi-Weekly Date	Fishing Time (Hrs.)	Actual Catch	Anticipated Catch [a]	Anticipated Cumulative Escapement [b]	Actual Cumulative Escapement [c]
May 17 Wed	12	38,851	35,477	344	-
May 20 Sat	12	85,602	44,334	3,661	1,151
May 24 Wed	12	68,603	77,673	13,737	3,623
May 27 Sat	0		101,085	29,178	8,493
May 31 Wed	6	80,782	90,801	60,752	43,463
June 03 Sat	12	78,888	96,622	93,282	74,722
June 07 Wed	12	46,023	65,441	144,654	104,311
June 10 Sat	0		60,676	185,827	123,493
June 14 Wed	0		45,560	230,119	161,124
June 17 Sat	0		55,811	259,495	182,744
June 21 Wed	0		47,483	289,429	232,688
June 24 Sat	12	80,270	45,583	311,518	284,076
June 28 Wed	24	62,063	46,792	338,472	334,390
July 01 Sat	24	56,841	47,683	360,190	366,215
July 05 Wed	36	88,486	49,719	399,159	411,138
July 08 Sat	36	55,608	55,208	433,656	436,528
July 12 Wed	36	54,672	50,269	491,150	480,182
July 15 Sat	36	43,132	47,464	534,595	505,395
July 19 Wed	36	25,691	38,979	595,908	529,400
July 22 Sat	24	6,948	35,729	638,785	545,949
July 26 Wed	12	3,068	20,777	683,464	565,991
July 29 Sat	12	934	19,170	707,387	576,113
Aug 02 Wed	12	872	10,142	733,668	585,550
Total	366	877,334	1,188,478	733,668	585,550

[a] Based on average historic catches for comparable dates (1992-1999).

[b] Based on historical escapements at Miles Lake sonar, includes upriver chinook escapement component and sockeye broodstock for the Gulkana Hatchery. Does not include sockeye escapements for the Copper/Bering delta streams.

[c] Escapement estimate from sonar counters at Miles Lake. Sonar counts ended August 3



Appendix 2 (continued). Anticipated versus actual semi-weekly and cumulative harvest of sockeye salmon in the Copper River drift gillnet fishery, 2000.

Appendix 3. Daily sockeye salmon escapement estimates at Miles Lake sonar, 2000.

Date	Water Level [a]	Estimated Daily Escapement North Bank		South Bank		Daily	Cumulative	Escapement Objective Daily	Cumulative	0600 Count	Projected Daily
16-May	39.32	0				0	0	0	0		
17-May	39.31	0		0		0	0	344	344		
18-May	39.35	111	c	226	b	337	337	824	1,168		
19-May	39.44	150	c	306		456	793	1,158	2,326	86	344
20-May	39.57	118	c	240		358	1,151	1,335	3,661	62	248
21-May	39.57	156	c	318		474	1,625	1,346	5,007	28	112
22-May	39.57	152	c	310		462	2,087	1,872	6,878	64	256
23-May	39.52	197	c	403		600	2,687	2,720	9,598	92	368
24-May	39.47	308	c	628		936	3,623	4,139	13,737	74	296
25-May	39.49	407	c	830		1,237	4,860	4,297	18,035	74	296
26-May	39.52	345	c	704		1,049	5,909	4,587	22,622	102	408
27-May	39.51	850	c	1,734		2,584	8,493	6,557	29,178	200	800
28-May	39.65	1,059	c	2,161		3,220	11,713	8,580	37,758	382	1,528
29-May	39.74	2,779	d	7,085		9,864	21,577	6,173	43,931	842	3,368
30-May	39.85	4,589		7,863		12,452	34,029	7,275	51,206	2,253	9,012
31-May	39.99	2,916		6,518		9,434	43,463	9,547	60,752	1,107	4,428
01-Jun	40.09	2,319		8,038		10,357	53,820	10,022	70,774	1,364	5,456
02-Jun	40.17	2,011		7,355		9,366	63,186	11,477	82,252	1,180	4,720
03-Jun	40.28	3,272		8,264		11,536	74,722	11,030	93,282	2,096	8,384
04-Jun	40.44	1,846		3,905		5,751	80,473	12,612	105,894	982	3,928
05-Jun	40.64	1,414	e	5,368		6,782	87,255	13,912	119,806	1,408	5,632
06-Jun	40.93	1,414	e	8,104		9,518	96,773	12,585	132,391	1,486	5,944
07-Jun	41.27	170		7,368	f	7,538	104,311	12,263	144,654	1,808	7,232
08-Jun	41.38	548		6,403		6,951	111,262	14,350	159,004	1,557	6,228
09-Jun	41.83	634		3,877		4,511	115,773	13,691	172,695	706	2,824
10-Jun	41.85	1,102		6,618		7,720	123,493	13,132	185,827	1,896	7,584
11-Jun	41.91	1,904		8,129		10,033	133,526	12,601	198,427	2,401	9,604
12-Jun	41.94	1,848		8,887		10,735	144,261	11,709	210,136	2,190	8,760
13-Jun	42.10	701		8,950		9,651	153,912	10,253	220,390	2,504	10,016
14-Jun	42.30	554		6,658		7,212	161,124	9,729	230,119	1,362	5,448
15-Jun	42.43	376		7,730		8,106	169,230	10,526	240,645	1,819	7,276
16-Jun	42.43	289		6,299		6,588	175,818	9,456	250,101	1,609	6,436
17-Jun	42.34	216		6,710		6,926	182,744	9,395	259,495	1,199	4,796
18-Jun	42.17	524		10,078		10,602	193,346	8,086	267,581	1,501	6,004
19-Jun	42.07	391		13,625		14,016	207,362	7,313	274,895	2,350	9,400
20-Jun	42.03	431		12,102		12,533	219,895	7,630	282,524	2,134	8,536
21-Jun	41.90	470		12,323		12,793	232,688	6,905	289,429	2,861	11,444
22-Jun	41.68	609		16,181		16,790	249,478	7,144	296,574	2,837	11,348
23-Jun	41.49	557		18,212		18,769	268,247	7,544	304,118	3,620	14,480
24-Jun	41.50	665		15,164		15,829	284,076	7,400	311,518	4,289	17,156
25-Jun	41.74	871		15,289		16,160	300,236	7,308	318,826	3,250	13,000
26-Jun	42.11	618		8,792		9,410	309,646	6,696	325,521	2,297	9,188
27-Jun	42.39	315		10,972		11,287	320,933	6,597	332,118	2,314	9,256
28-Jun	42.74	320		13,137		13,457	334,390	6,354	338,472	2,809	11,236
29-Jun	43.07	658		12,851		13,509	347,899	7,008	345,479	3,654	14,616
30-Jun	43.35	256		7,712		7,968	355,867	7,070	352,549	1,950	7,800
01-Jul	43.39	230		10,118		10,348	366,215	7,641	360,190	1,566	6,264

-Continued-

Appendix 3. (page 2 of 2)

Date	Water Level [a]	North Bank	Estimate South Bank	Daily	Cumulative	Escapement Objective Daily	Escapement Objective Cumulative	0600 Count	Projected Daily
02-Jul	43.39	319	10,027	10,346	376,561	8,358	368,548	2,476	9,904
03-Jul	43.41	412	10,589	11,001	387,562	9,339	377,886	1,984	7,936
04-Jul	43.42	271	12,948	13,219	400,781	10,185	388,072	2,811	11,244
05-Jul	43.43	215	10,142	10,357	411,138	11,087	399,159	2,296	9,184
06-Jul	43.49	202	8,390	8,592	419,730	10,669	409,828	2,508	10,032
07-Jul	43.41	296	7,948	8,244	427,974	10,738	420,566	2,032	8,128
08-Jul	43.37	428	8,126	8,554	436,528	13,090	433,656	1,791	7,164
09-Jul	43.41	772	8,492	9,264	445,792	14,004	447,660	2,018	8,072
10-Jul	43.40	939	10,460	11,399	457,191	14,013	461,673	2,809	11,236
11-Jul	43.31	672	11,625	12,297	469,488	13,964	475,637	2,143	8,572
12-Jul	43.10	399	10,295	10,694	480,182	15,513	491,150	2,822	11,288
13-Jul	42.96	499	8,682	9,181	489,363	14,638	505,788	1,563	6,252
14-Jul	43.03	524	8,809	9,333	498,696	14,700	520,488	2,793	11,172
15-Jul	42.99	271	6,428	6,699	505,395	14,107	534,595	1,675	6,700
16-Jul	42.99	739	5,839	6,578	511,973	16,366	550,961	1,331	5,324
17-Jul	43.17	548	6,531	7,079	519,052	15,241	566,202	1,949	7,796
18-Jul	43.31	502	4,855	5,357	524,409	14,196	580,398	1,624	6,496
19-Jul	43.37	332	4,659	4,991	529,400	15,510	595,908	752	3,008
20-Jul	43.29	425	5,482	5,907	535,307	17,102	613,010	1,168	4,672
21-Jul	43.12	227	6,731	6,958	542,265	13,512	626,522	1,541	6,164
22-Jul	43.04	196	3,488	3,684	545,949	12,263	638,785	855	3,420
23-Jul	42.84	151	3,378	3,529	549,478	12,488	651,273	1,067	4,268
24-Jul	42.80	394	3,847	4,241	553,719	11,902	663,175	823	3,292
25-Jul	42.69	177	5,478	5,655	559,374	10,496	673,671	790	3,160
26-Jul	42.57	553	6,064	6,617	565,991	9,794	683,464	1,377	5,508
27-Jul	42.55	297	4,720	5,017	571,008	8,789	692,253	1,346	5,384
28-Jul	42.59	310	2,711	3,021	574,029	8,131	700,384	795	3,180
29-Jul	42.69	172	1,912	2,084	576,113	7,003	707,387	593	2,372
30-Jul	42.49	154	2,451	2,605	578,718	7,139	714,526	680	2,720
31-Jul	42.52	266	1,989	2,255	580,973	6,669	721,195	528	2,112
01-Aug	42.26	347	1,906	2,253	583,226	6,392	727,587	435	1,740
02-Aug	42.26	363 [g]	1,961	2,324	585,550	6,081	733,668	613	2,452
03-Aug	42.28		1,947 [h]	1,947	587,497	5,476	739,145	349	1,396
04-Aug	42.42				587,497	4,317	743,462		
05-Aug					587,497	3,990	747,452		

[a] Meters above sea level.

[b] South bank tripod was deployed on tripod at 0800.

[c] Extrapolated using 49% of south bank counts.

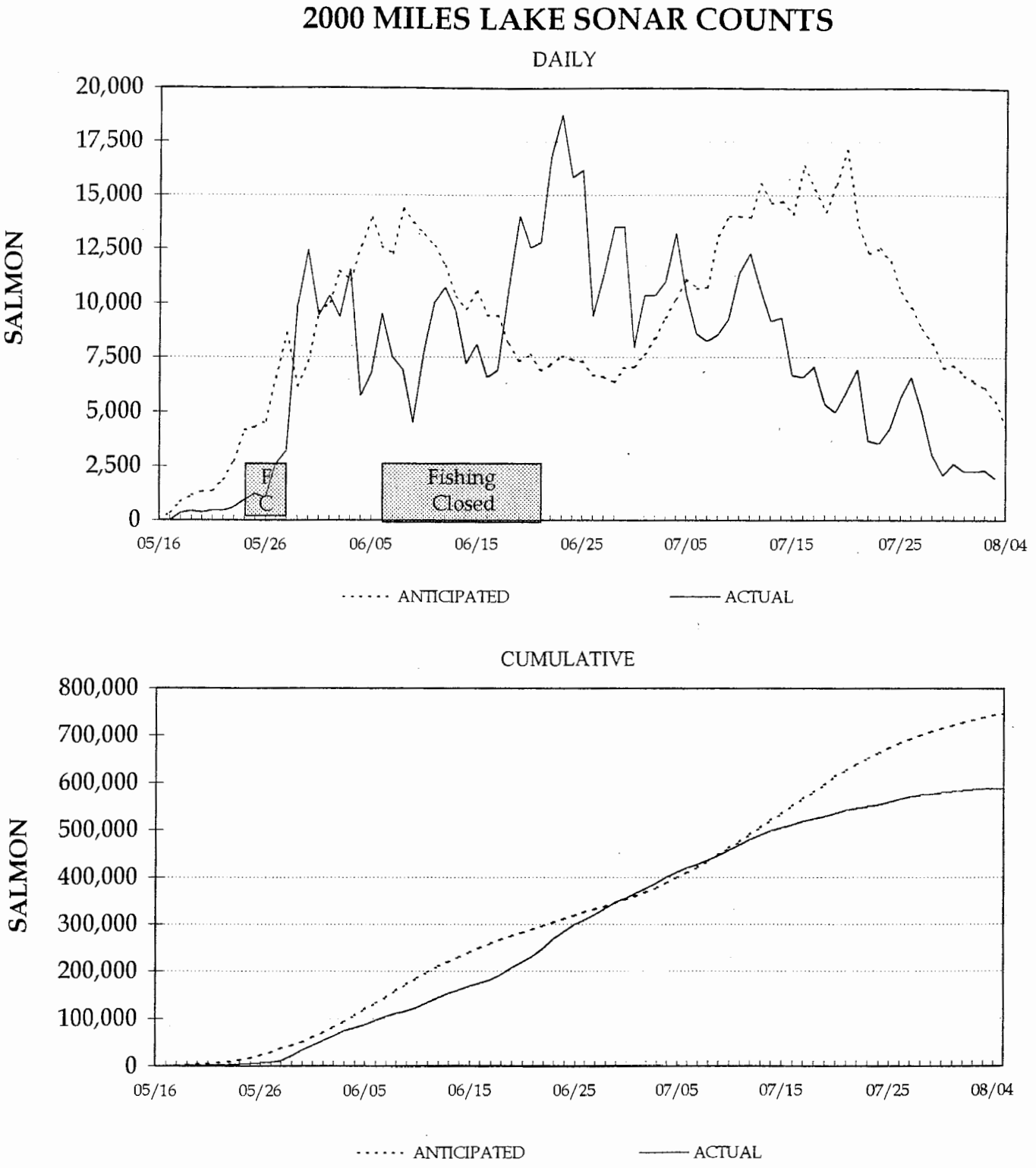
[d] North bank tripod was deployed at 0900.

[e] Interpolated from 3 days before and after.

[f] South bank transducer was deployed on permanent substrate at 1100.

[g] North bank tripod was pulled at 2400.

[h] South bank transducer pulled at 2400.



Appendix 4. Anticipated versus actual daily and cumulative salmon escapement, Miles Lake sonar, 2000.

Appendix 5 . Aerial survey indices of sockeye salmon escapement to the upper Copper River drainage, 1991 - 2000. Early timed sockeye systems shaded.

	Year survey Indices										10 Year Average
Location [a]	1991	1992	1993 [c]	1994 [c]	1995 [c]	1996	1997	1998	1999	2000	1983-92
Fish Lake	4,350	4,250				4,800		4,900	1,880	5,000	6,418
Bad Crossing 1&2	2,625	500				780		7,800	195	19	2,604
Suslota Lake	210	1,350				4,100		1,060	0	3,000	1,416
Dickey Lake	56	46				0		350	11	0	115
Keg Creek	95	630				850	420	160	125	0	725
Mahlo Creek	3,750	250				3,800	11,800	12,300	325	1,000	2,648
St. Anne Creek	4,700	450				3,500	4,800	4,100	1,300	1,100	4,888
Fish Cr.-Mentasta	1,050	480				400		1,400	450	800	963
Swede Lake	110	875				20		770	270	135	531
Tana River	750	740									1,345
Mentasta Lake	1,550	600				2,800		6,100	715	1,200	3,277
Tanada Lake	1,725	2,250		6,270	3,100				350	3,200	3,849
Salmon Creek	350	1,500							0	500	825
Paxson Inlt-Mud Cr	4,800	6,450				16,800		15,200	5,700	2,200	6,560
Mud Creek and Lake	100	425				240			20	30	172
Mendeltna Creek	3,050	1,750				1,250	400		120	2,800	2,470
Paxson Lake Outlet	2,300	950						200	1,800	1,000	2,661
Mud Cr.- Summit L.	9,625	3,800						700	820	140	7,445
Long Lake	[b]	1,050									1,577
Tonsina Lake	[b]	1,350									1,080
Totals	41,196	29,696									51,569

a The escapement figures in this table are based on peak aerial survey estimates and weir counts from a majority of the known spawning areas in the upper Copper River drainage. These indices are not intended to provide a true estimate of total escapement for these stocks, but a comparable index based upon the best data currently available. An effort has been made to standardize the estimate across years, however counts were obtained only as environmental conditions allowed and may not necessarliy correspond to periods of peak abundance. Missing counts are generally a result of bad weather, high water or other factors that prevent surveys for that given year.

b No survey flown.

c The Tanada Lake system was the only system surveyed in 1994 and 1995, no surveys were flown in 1993.

d In 1999, only two survey rounds were flown on July 23&24, and on Augusyt 6&7.

d In 2000, two or three survey rounds were flown for each system.

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Appendix 6. Estimated exploitation rate calculated with a 6 day lag time.

Commercial harvest of upriver sockeye salmon based on the MEAN 1982-1987 SPA proportions

Stat Week	Year 1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
20 & 21	186,719	190,814	75,789	34,159	47,991	174,468	243,551	601,090	162,804	137,583	99,060
22	119,697	154,408	171,668	215,383	157,305	199,893	412,791	502,950	138,210	189,469	56,258
23	36,745	160,468	39,684	126,554	137,543	144,264	170,486	280,707	115,534	124,727	104,914
24	82,027	72,563	73,189	154,564	54,207	44,148	227,349	233,143	108,307		34,920
25	45,630	52,939	66,650	79,246	42,766	60,590	125,144	146,395	61,486	75,019	
Total	470,818	631,193	426,980	609,906	439,812	623,364	1,179,322	1,764,285	586,341	526,798	295,152

Miles Lake Sonar Escapement Index Counts lagged back **6** days.

Stat Week	Year [a] 1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
20 & 21	109,314	39,744	**5,019**	198,880	23,748	83,781	69,435	234,589	50,219	**4,400**	5,909
22	65,414	109,150	56,947	109,800	32,844	46,784	147,065	180,311	157,296	21,453	57,277
23	108,815	68,795	125,851	146,162	93,892	81,829	200,777	191,263	100,421	69,577	52,587
24	70,386	86,331	118,310	79,691	87,351	101,356	81,958	120,737	139,043	133,658	60,045
25	56,942	58,476	73,222	33,085	116,085	70,380	72,702	64,413	83,210	97,773	92,429
Total	410,871	362,496	379,349	567,618	353,920	384,130	571,937	791,313	530,189	326,861	268,247

Estimated exploitation rate of upriver sockeye salmon by the commercial gillnet fishery.

Stat Week	Year [a] 1990	1991	1992 [b]	1993	1994	1995	1996	1997	1998	1999 [c]	2000	Average
20 & 21	0.63	0.83	**0.94**	0.15	0.67	0.68	0.78	0.72	0.76	**0.97**	0.94	0.73
22	0.65	0.59	0.75	0.66	0.83	0.81	0.74	0.74	0.47	0.90	0.50	0.69
23	0.25	0.70	0.24	0.46	0.59	0.64	0.46	0.59	0.53	0.64	0.67	0.53
24	0.54	0.46	0.38	0.66	0.38	0.30	0.74	0.66	0.44	0.00	0.37	0.45
25	0.44	0.48	0.48	0.71	0.27	0.46	0.63	0.69	0.42	0.43	0.00	0.46
Average	0.50	0.61	0.56	0.53	0.55	0.58	0.67	0.68	0.53	0.59	0.49	0.57

[a] Statistical weeks with less than 7 days of sonar counts are in bold font.

[b] In 1992, the sonar operated only three days in statistical weeks 20 and 21 due to river conditions.

[c] In 1999, the sonar operated only six days in statistical weeks 20 and 21 due to river conditions.

Appendix 7. Estimated exploitation rate calculated with a 9 day lag time.

Commercial harvest of upriver sockeye salmon based on the MEAN 1982-1987 SPA proportions

Stat	Year										
Week	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
20 & 21	186,719	190,814	75,789	34,159	47,991	174,468	243,551	601,090	162,804	137,583	99,060
22	119,697	154,408	171,668	215,383	157,305	199,893	412,791	502,950	138,210	189,469	56,258
23	36,745	160,468	39,684	126,554	137,543	144,264	170,486	280,707	115,534	124,727	104,914
24	82,027	72,563	73,189	154,564	54,207	44,148	227,349	233,143	108,307		34,920
25	45,630	52,939	66,650	79,246	42,766	60,590	125,144	146,395	61,486	75,019	
Total	470,818	631,193	426,980	609,906	439,812	623,364	1,179,322	1,764,285	586,341	526,798	295,152

Miles Lake Sonar Escapement Index Counts lagged back **9** days.

Stat	Year [a]										
Week	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
20 & 21	134,250	95,536	**25,296**	237,200	31,649	92,728	147,899	342,695	112,833	16,661	21,577
22	77,103	83,059	85,685	140,970	48,451	55,775	162,354	165,472	140,974	20,313	65,678
23	101,928	78,557	139,506	116,223	104,745	108,432	146,371	153,893	124,839	129,435	57,006
24	69,043	67,019	101,454	54,900	101,103	74,032	78,924	98,095	102,739	104,484	63,101
25	40,791	65,180	51,016	28,774	108,462	59,622	77,280	65,343	88,041	106,631	102,284
Total	423,115	389,351	402,957	578,067	394,410	390,589	612,828	825,498	569,426	377,524	309,646

Estimated exploitation rate of upriver sockeye salmon by the commercial gillnet fishery.

Stat	Year [a]											
Week	1990	1991	1992 [b]	1993	1994	1995	1996	1997	1998	1999 [c]	2000	Average
20 & 21	0.58	0.67	**0.75**	0.13	0.60	0.65	0.62	0.64	0.59	0.89	0.82	0.63
22	0.61	0.65	0.67	0.60	0.76	0.78	0.72	0.75	0.50	0.90	0.46	0.67
23	0.26	0.67	0.22	0.52	0.57	0.57	0.54	0.65	0.48	0.49	0.65	0.51
24	0.54	0.52	0.42	0.74	0.35	0.37	0.74	0.70	0.51	0.00	0.36	0.48
25	0.53	0.45	0.57	0.73	0.28	0.50	0.62	0.69	0.41	0.41	0.00	0.47
Average	0.51	0.59	0.52	0.54	0.51	0.58	0.65	0.69	0.50	0.54	0.46	0.55

[a] Statistical weeks with less than 7 days of sonar counts are in bold font.

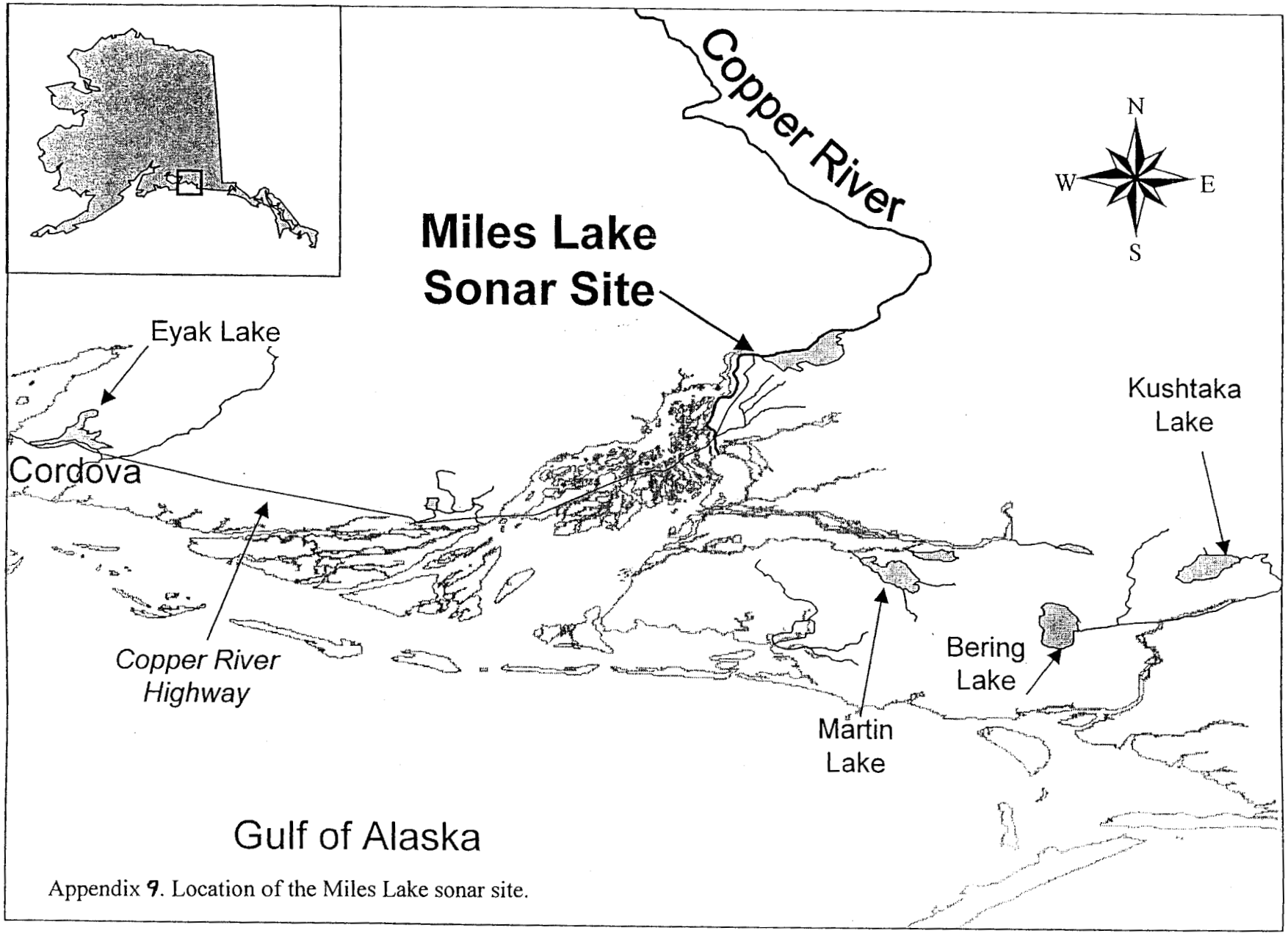
[b] In 1992, the sonar operated only six days in statistical weeks 20 and 21 due to river conditions.

[c] In 1999, the sonar operated only nine days in statistical weeks 20 and 21 due to river conditions.

Appendix 8. Daily cumulative salmon escapement estimates, Miles Lake sonar, Copper River with 1995-1998 and 1990-2000 averages.

Date	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	1995-98 Average	1990 - 00 Average	Date
15-May						449						449	449	15-May
16-May						928						928	928	16-May
17-May					448	1,475						1,475	1,133	17-May
18-May					1,134	1,997	101	136	158	0	337	455	540	18-May
19-May					2,086	3,292	173	304	412	0	793	829	986	19-May
20-May				9,503	3,041	6,320	308	790	585	0	1,151	1,526	2,580	20-May
21-May	1,121	1,087		23,180	4,651	9,824	646	1,254	2,062	0	1,625	2,569	4,365	21-May
22-May	5,964	2,804		45,886	7,073	12,632	1,669	2,996	3,339	0	2,087	3,787	8,022	22-May
23-May	13,141	5,965		74,311	10,631	16,933	3,435	5,740	4,666	960	2,687	5,737	13,110	23-May
24-May	25,064	8,430		106,291	13,528	19,406	4,765	17,936	8,248	1,440	3,623	9,236	19,815	24-May
25-May	39,397	11,476		144,872	17,611	21,247	6,128	44,859	14,099	2,040	4,860	15,539	29,284	25-May
26-May	50,734	14,750		168,519	20,893	24,279	8,320	72,248	19,707	2,412	5,909	22,146	37,265	26-May
27-May	62,794	18,643	1,226	181,404	23,748	28,085	13,110	104,226	28,718	3,271	8,493	30,984	42,058	27-May
28-May	70,228	22,032	2,657	198,880	26,795	35,253	26,289	150,408	38,993	4,400	11,713	44,509	52,680	28-May
29-May	79,404	25,965	5,019	212,036	29,683	45,131	38,297	196,947	50,219	6,857	21,577	59,838	64,248	29-May
30-May	88,945	30,382	10,755	220,514	31,649	57,910	49,441	234,501	68,661	13,051	34,029	76,266	76,342	30-May
31-May	99,288	39,744	18,686	237,200	36,265	68,665	69,435	280,698	91,679	16,661	43,463	95,100	91,407	31-May
01-Jun	109,314	56,577	25,296	253,673	45,688	77,645	94,965	312,255	112,991	18,861	53,820	111,756	106,070	01-Jun
02-Jun	119,223	77,728	33,215	276,504	53,455	87,073	120,942	342,999	137,197	20,825	63,186	128,704	121,754	02-Jun
03-Jun	127,799	95,536	44,750	291,095	56,592	92,720	148,207	361,077	162,921	23,291	74,722	143,823	135,211	03-Jun
04-Jun	135,371	110,093	52,671	308,680	62,735	99,465	170,438	378,639	188,451	25,853	80,473	157,220	147,507	04-Jun
05-Jun	145,544	128,766	61,966	334,459	68,000	105,360	188,447	394,827	207,515	28,688	87,255	168,682	159,959	05-Jun
06-Jun	155,954	140,454	76,518	360,102	80,100	114,596	199,757	414,812	221,645	30,515	96,773	179,683	172,576	06-Jun
07-Jun	167,091	148,894	93,252	378,170	96,832	122,640	216,500	437,424	240,246	36,974	104,311	193,016	186,279	07-Jun
08-Jun	174,728	158,365	110,981	398,932	114,854	128,378	243,085	471,393	253,965	44,244	111,262	208,721	201,576	08-Jun
09-Jun	184,633	170,030	131,700	423,929	132,896	133,857	278,769	508,471	261,290	53,514	115,773	225,279	218,345	09-Jun
10-Jun	196,293	178,595	155,130	443,723	150,484	141,911	310,561	542,651	271,784	68,367	123,493	243,128	235,510	10-Jun
11-Jun	212,474	186,699	173,721	454,842	162,756	153,861	339,646	573,592	290,255	95,430	133,526	264,385	253,432	11-Jun
12-Jun	236,403	199,387	187,817	473,164	175,764	161,135	375,283	592,711	307,936	121,915	144,261	283,873	271,637	12-Jun
13-Jun	260,851	208,453	206,074	486,036	184,845	170,080	402,319	606,075	329,654	146,787	153,912	301,471	288,046	13-Jun
14-Jun	275,153	217,689	226,530	494,393	200,484	184,101	417,277	622,155	357,935	166,409	161,124	318,167	303,451	14-Jun
15-Jun	283,543	232,656	250,487	507,744	212,163	195,954	432,825	645,375	378,804	183,605	169,230	334,299	318,890	15-Jun
16-Jun	293,655	247,023	264,401	521,991	226,390	215,738	446,634	662,364	396,065	202,407	175,818	349,838	333,527	16-Jun
17-Jun	306,350	257,152	278,910	529,612	237,835	235,656	456,932	684,165	416,826	218,428	182,744	365,792	347,533	17-Jun
18-Jun	314,402	268,203	293,803	534,533	255,058	253,594	464,291	706,257	435,361	229,088	193,346	380,323	360,688	18-Jun
19-Jun	324,165	281,124	306,127	540,857	274,450	269,619	479,594	718,968	446,979	242,095	207,362	394,103	373,787	19-Jun
20-Jun	333,480	295,270	325,607	545,757	285,948	286,482	491,665	726,812	458,479	256,791	219,895	406,687	386,073	20-Jun
21-Jun	343,772	304,020	342,489	549,293	297,647	301,912	499,235	735,201	470,755	270,893	232,688	418,447	397,196	21-Jun
22-Jun	353,929	311,850	351,941	552,157	310,952	311,774	510,086	752,754	481,543	285,638	249,478	431,879	408,665	22-Jun
23-Jun	364,095	318,208	359,175	557,226	329,638	317,094	525,630	760,459	492,450	295,906	268,247	443,298	419,285	23-Jun
24-Jun	373,435	324,171	365,494	563,297	353,920	324,451	535,856	765,769	505,971	312,821	284,076	454,824	430,340	24-Jun
25-Jun	383,445	331,831	372,169	567,618	368,060	333,662	543,819	771,229	518,972	326,861	300,236	465,796	440,308	25-Jun
26-Jun	390,257	341,331	379,349	570,336	380,264	343,651	552,487	779,214	530,189	342,012	309,646	476,200	449,578	26-Jun
27-Jun	399,491	351,686	385,615	573,706	394,410	359,676	562,742	791,225	540,911	362,557	320,933	489,674	461,052	27-Jun
28-Jun	406,372	362,496	393,699	578,067	403,623	373,349	571,937	801,652	553,733	377,524	334,390	502,097	471,578	28-Jun
29-Jun	410,871	372,935	402,957	583,043	419,482	383,072	584,558	812,061	569,584	392,365	347,899	514,923	482,812	29-Jun
30-Jun	414,846	382,048	410,373	591,427	430,327	387,474	597,649	825,802	584,265	406,871	355,867	526,321	492,772	30-Jun

Miles Lake sonar site

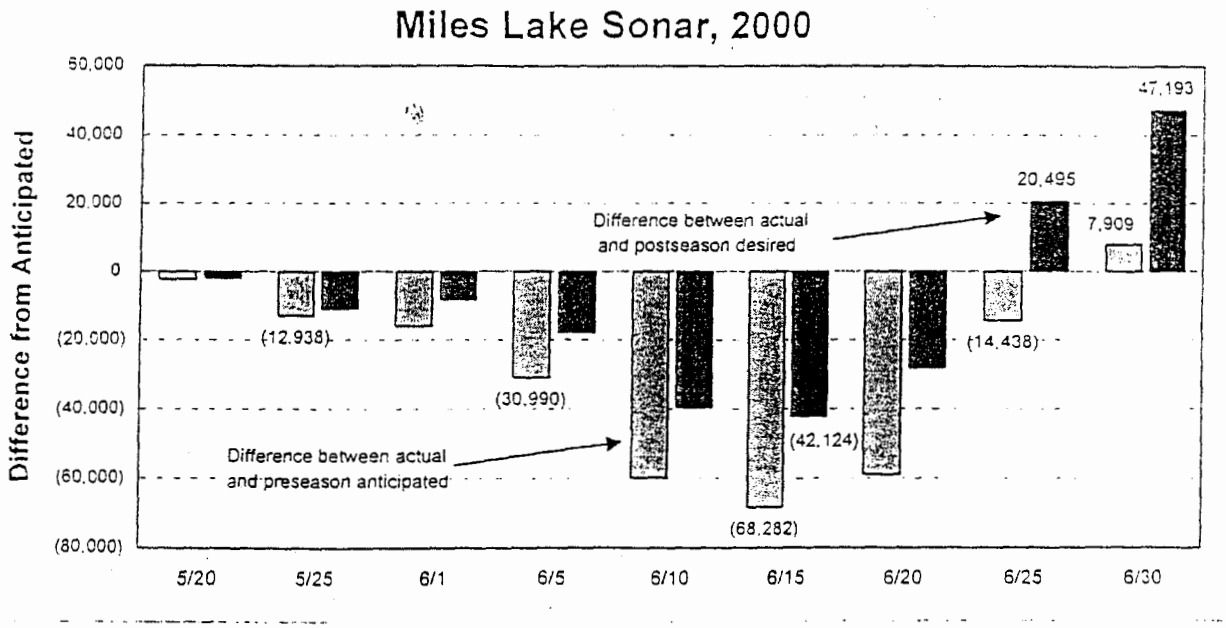


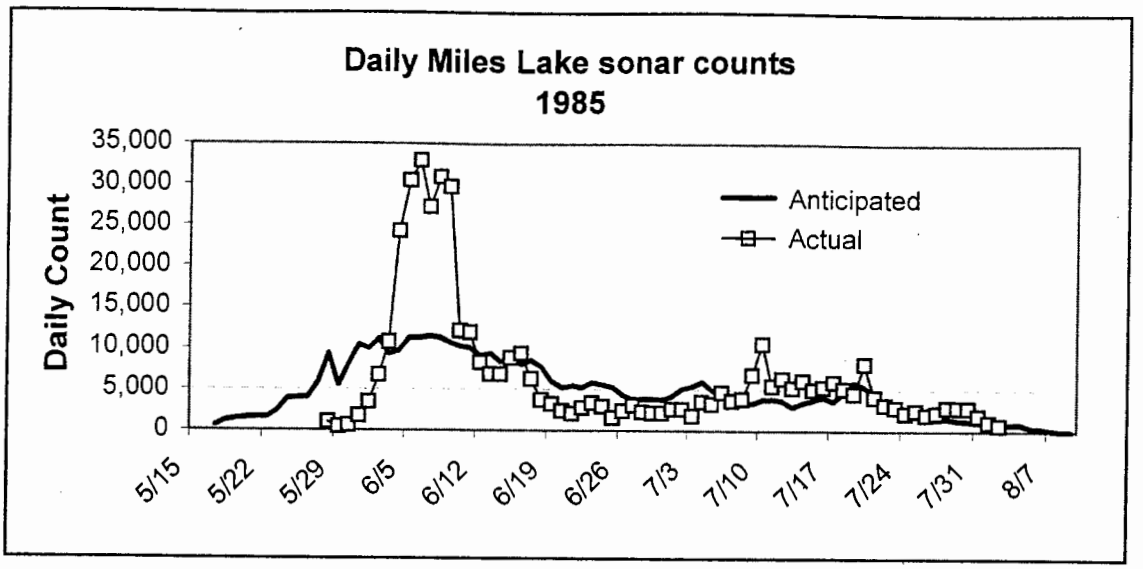
Appendix 9. Location of the Miles Lake sonar site.

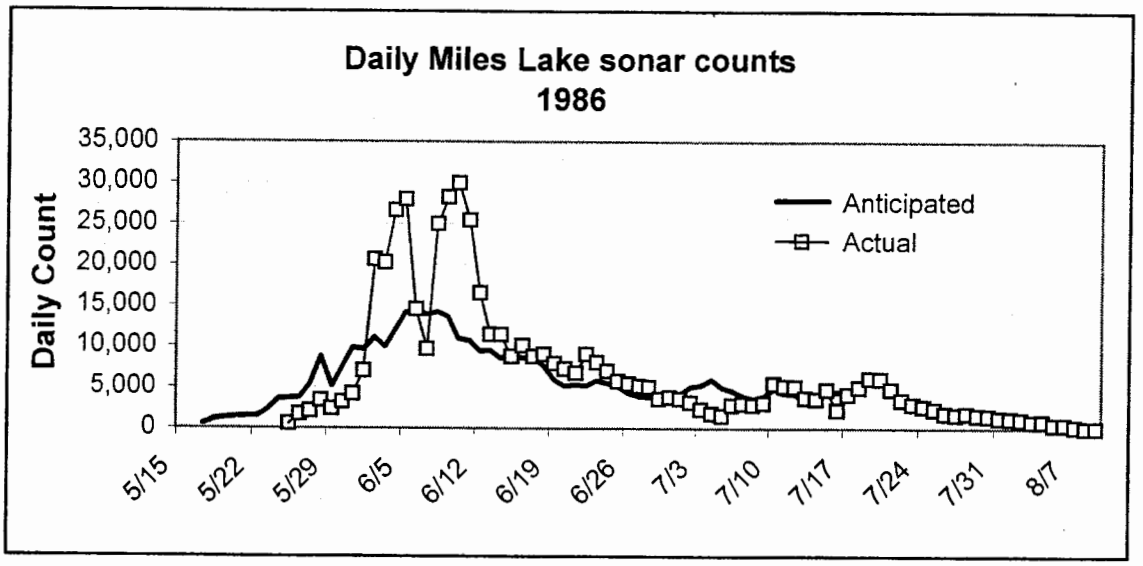
Appendix 10. Preseason anticipated and post season retrospective cumulative Miles Lake sonar counts compared to the actual counts

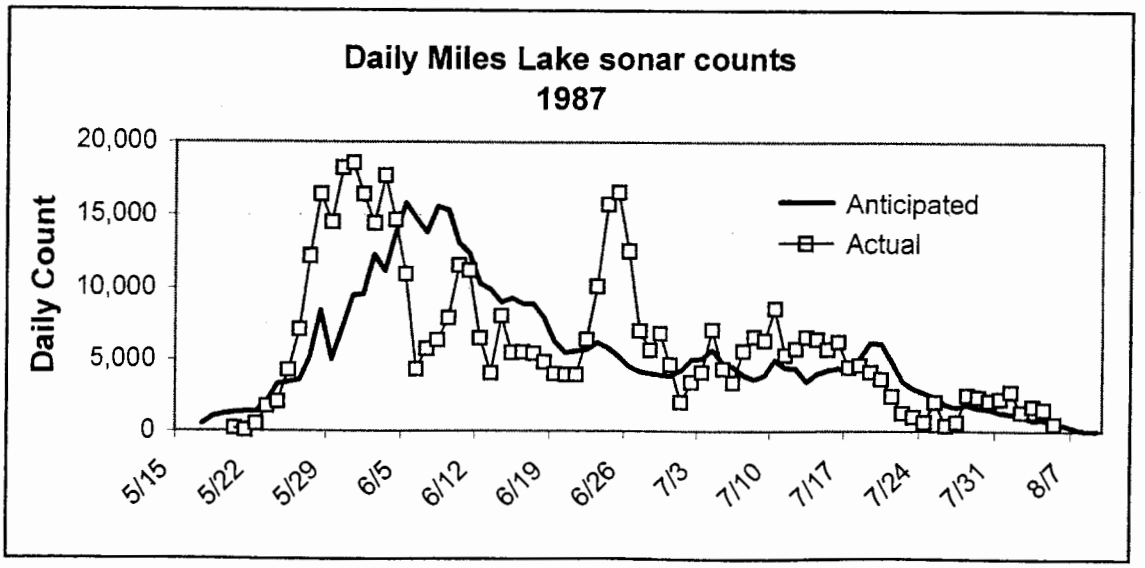
Date	Based on preseason anticipated				Based on postseason estimated run size			
	Preseason	Actual	Difference	Percentage [a]	Postseason	Actual	Difference	Percentage [a]
20-May	3,613	1,151	(2,462)	31.9%	3,243	1,151	(2,092)	35.5%
25-May	17,798	4,860	(12,938)	27.3%	15,856	4,860	(10,996)	30.7%
1-Jun	69,851	53,820	(16,031)	77.0%	62,119	53,820	(8,299)	86.6%
5-Jun	118,245	87,255	(30,990)	73.8%	105,133	87,255	(17,878)	83.0%
10-Jun	183,406	123,493	(59,913)	67.3%	163,124	123,493	(39,631)	75.7%
15-Jun	237,512	169,230	(68,282)	71.3%	211,354	169,230	(42,124)	80.1%
20-Jun	278,846	219,895	(58,951)	78.9%	248,107	219,895	(28,212)	88.6%
25-Jun	314,674	300,236	(14,438)	95.4%	279,741	300,236	20,495	107.3%
30-Jun	347,958	355,867	7,909	102.3%	308,674	355,867	47,193	115.3%
5-Jul	393,961	411,138	17,177	104.4%	347,760	411,138	63,378	118.2%
10-Jul	455,661	457,191	1,530	100.3%	399,424	457,191	57,767	114.5%
15-Jul	527,632	505,395	(22,237)	95.8%	459,324	505,395	46,071	110.0%
20-Jul	605,027	535,307	(69,720)	88.5%	523,621	535,307	11,686	102.2%
25-Jul	664,898	559,374	(105,524)	84.1%	572,992	559,374	(13,618)	97.6%
30-Jul	705,221	578,718	(126,503)	82.1%	606,202	578,718	(27,484)	95.5%

[a] The actual counts as a percentage of the desired counts.

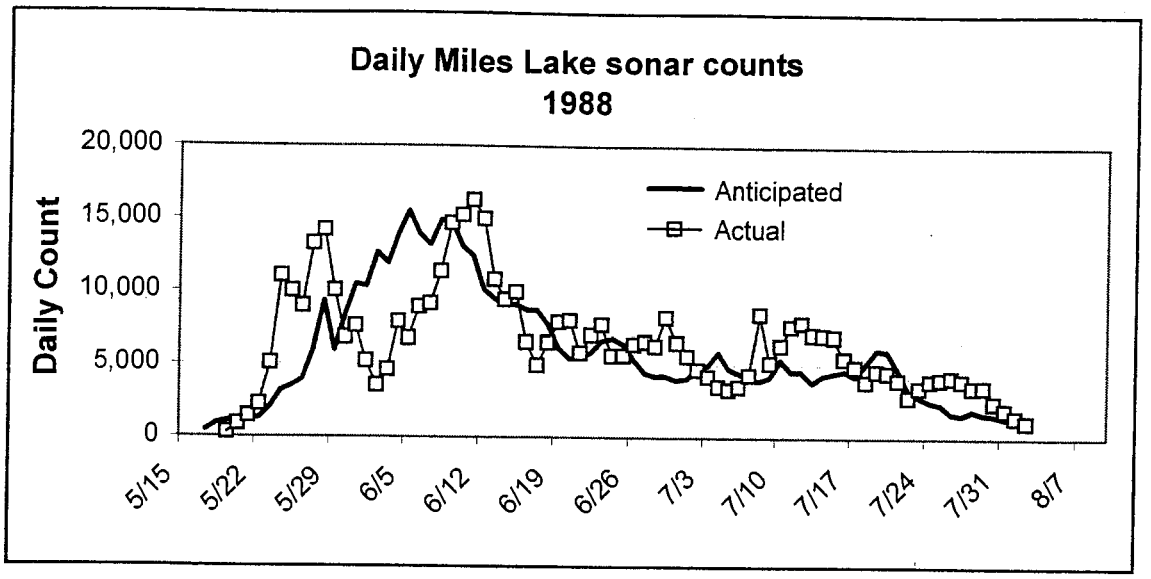


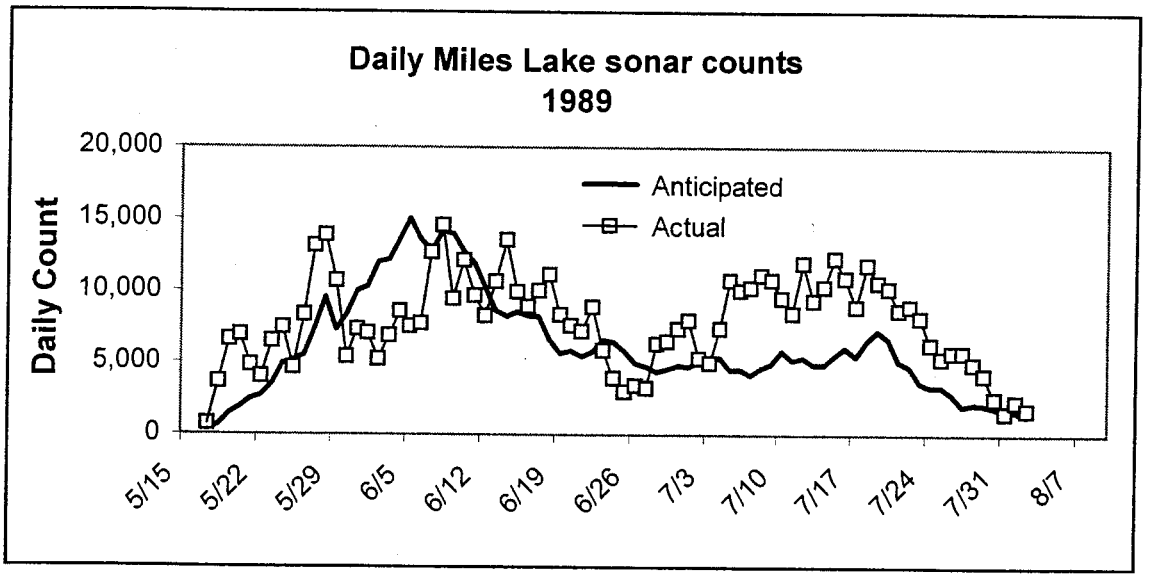


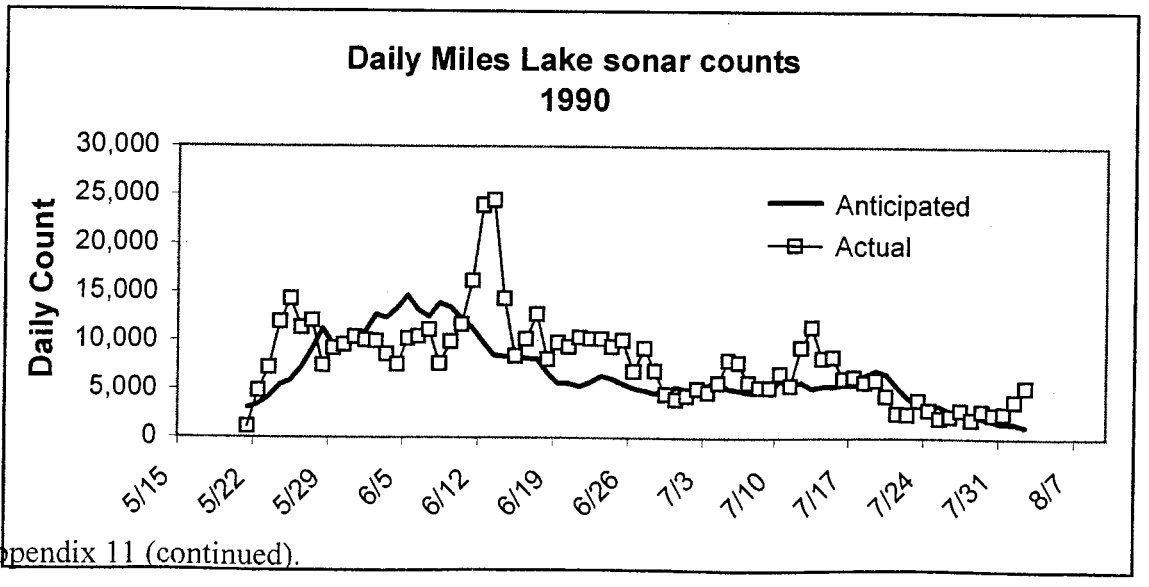




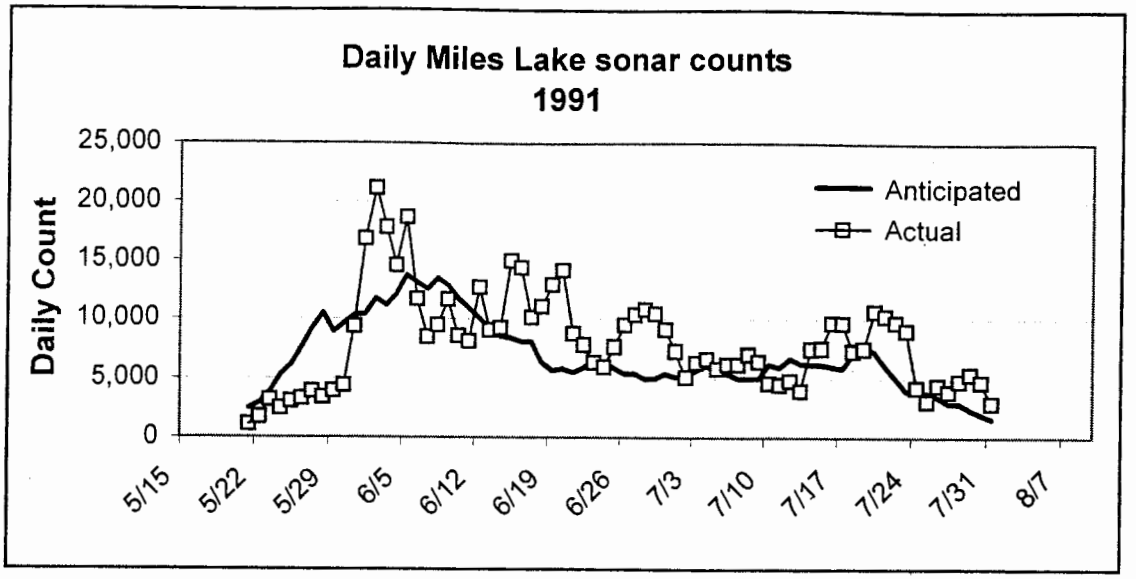
Appendix 11. Graphs of actual and anticipated daily sonar passage, 1985-2000.

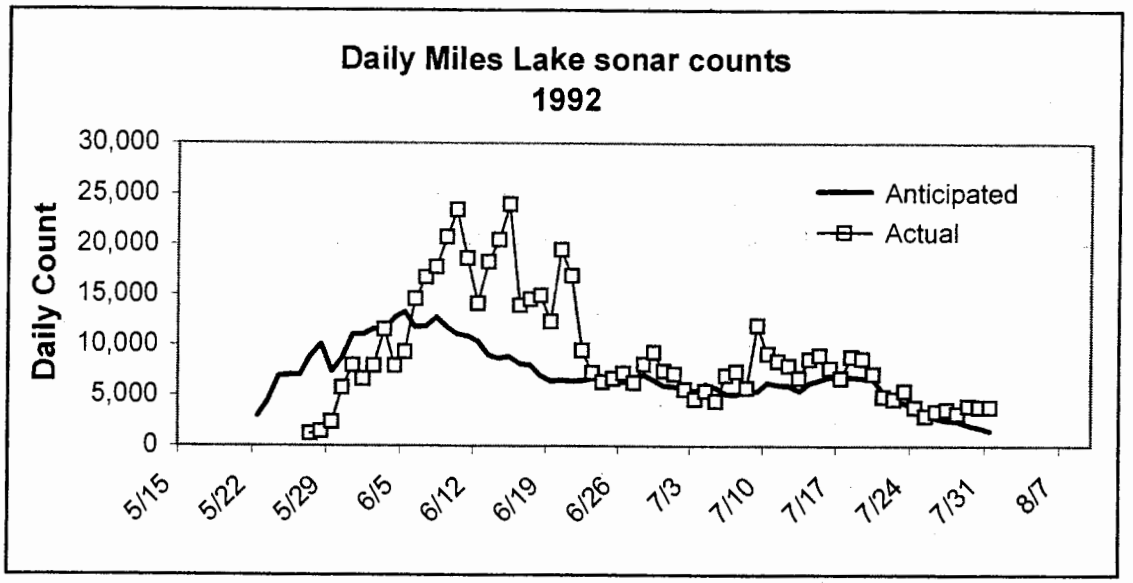


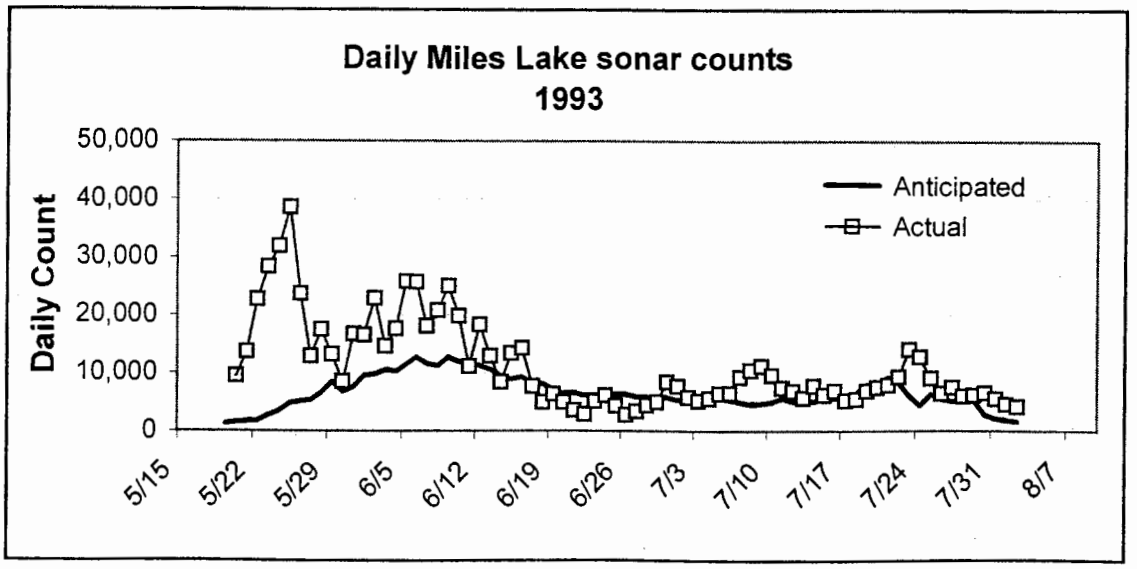




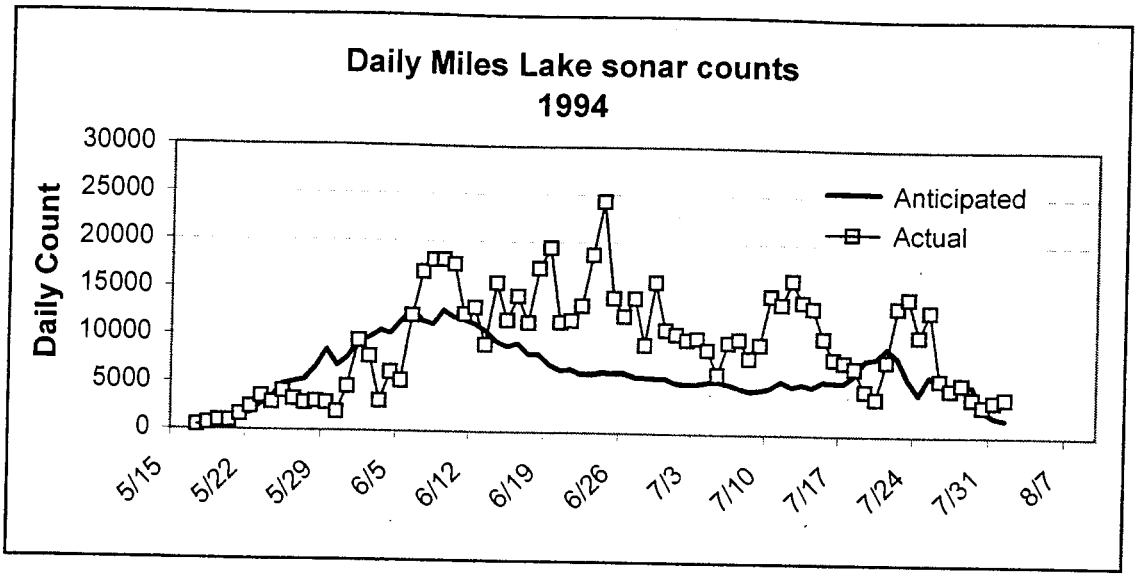
Appendix 11 (continued).

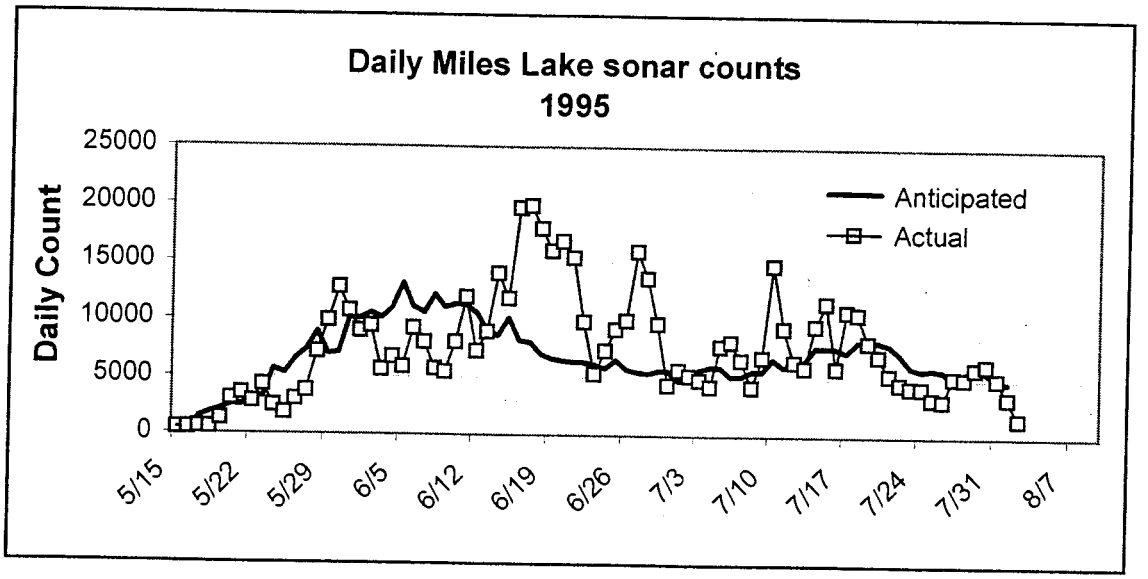


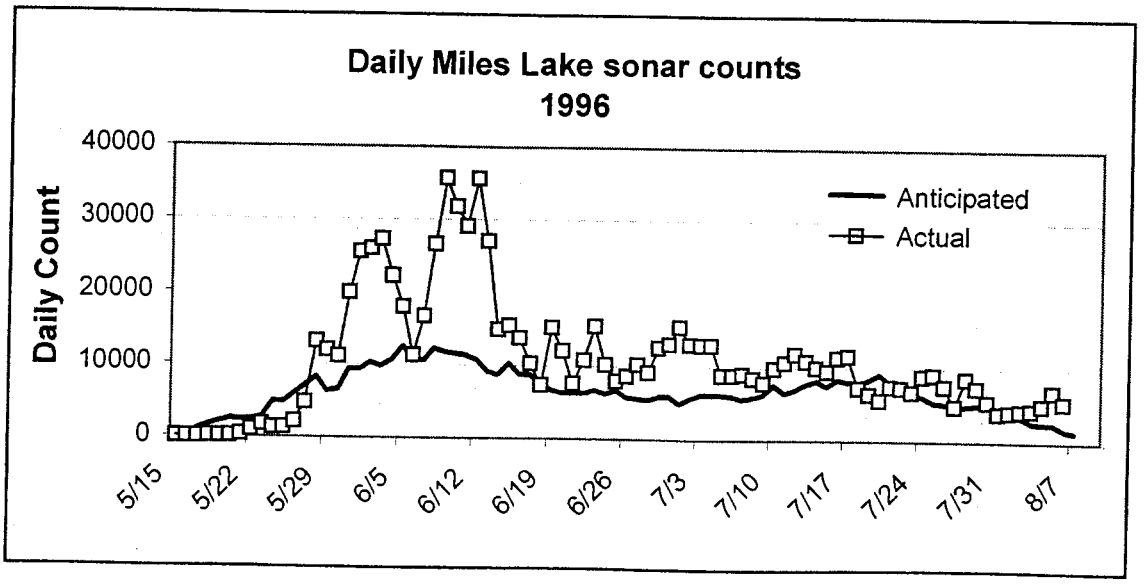


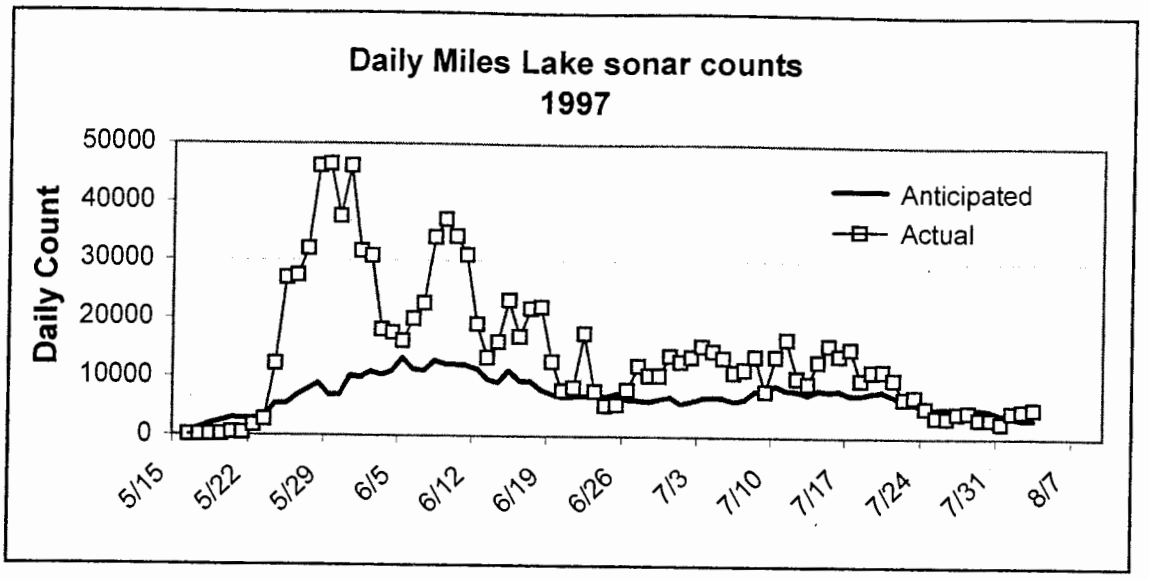


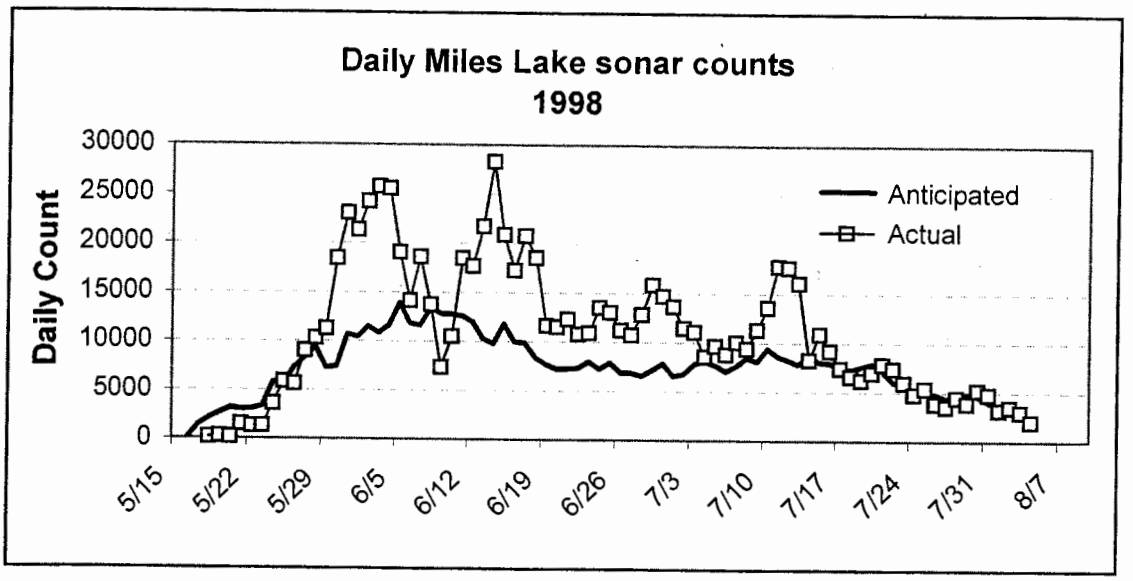
Appendix 11 (continued).

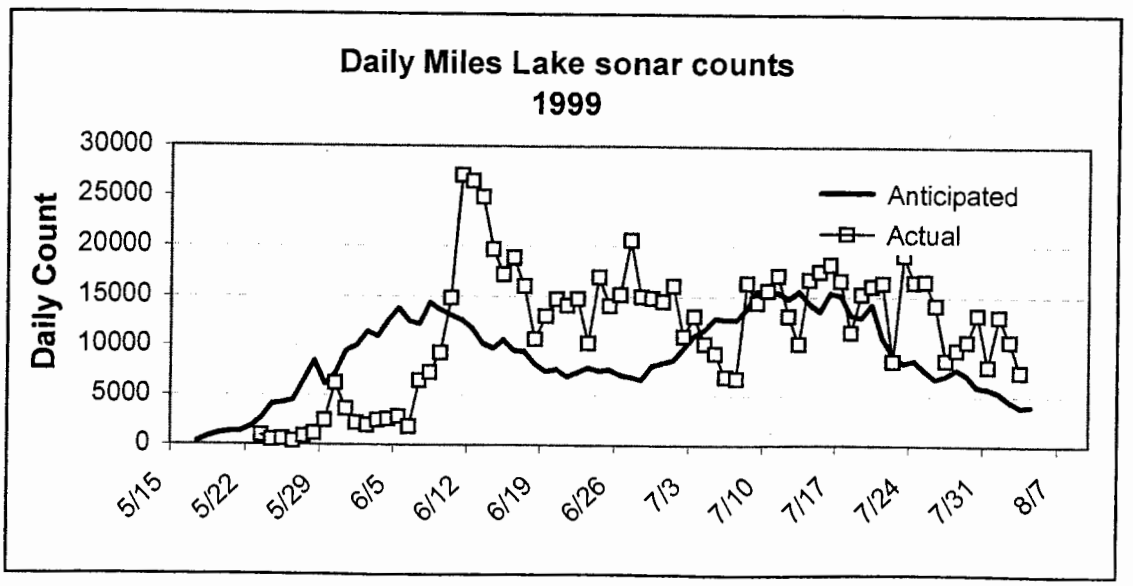

Daily Miles Lake sonar counts
1994
Daily Count
30000
25000
20000
15000
10000
5000
0
Anticipated
Actual
5/15
5/22
5/29
6/5
6/12
6/19
6/26
7/3
7/10
7/17
7/24
7/31
8/7

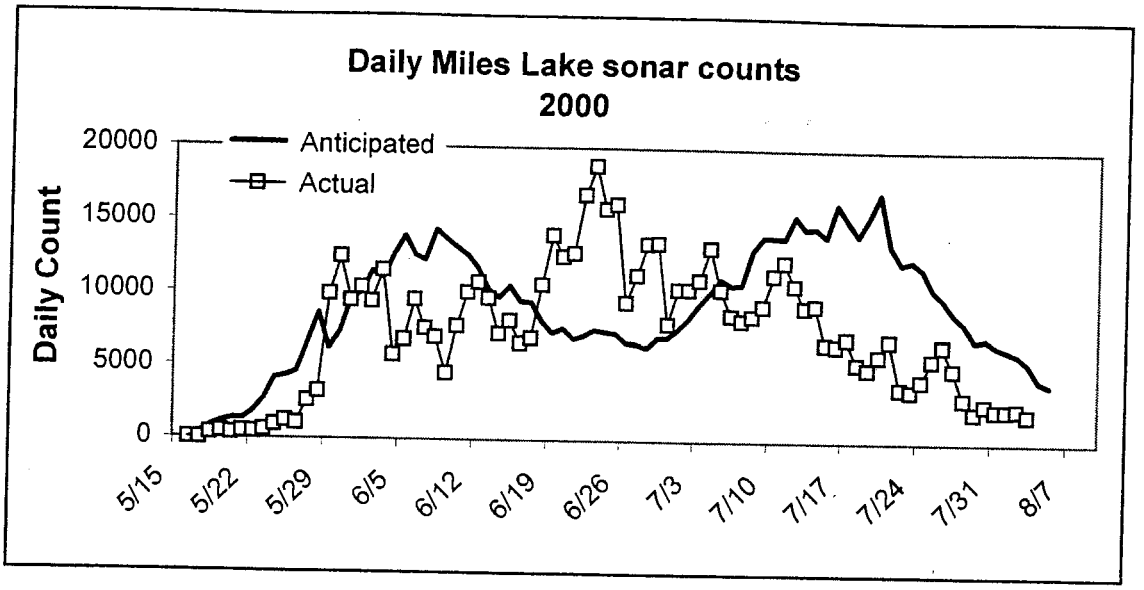

Daily Miles Lake sonar counts
1995
Daily Count
25000
20000
15000
10000
5000
0
Anticipated
Actual
5/15
5/22
5/29
6/5
6/12
6/19
6/26
7/3
7/10
7/17
7/24
7/31
8/7


Daily Miles Lake sonar counts
1996
Daily Count
40000
30000
20000
10000
0
Anticipated
Actual
5/15
5/22
5/29
6/5
6/12
6/19
6/26
7/3
7/10
7/17
7/24
7/31
8/7


Daily Miles Lake sonar counts
1997
Daily Count
50000
40000
30000
20000
10000
0
Anticipated
Actual
5/15
5/22
5/29
6/5
6/12
6/19
6/26
7/3
7/10
7/17
7/24
7/31
8/7


Daily Miles Lake sonar counts
1998
Daily Count
30000
25000
20000
15000
10000
5000
0
Anticipated
Actual
5/15
5/22
5/29
6/5
6/12
6/19
6/26
7/3
7/10
7/17
7/24
7/31
8/7


Daily Miles Lake sonar counts
1999
Daily Count
30000
25000
20000
15000
10000
5000
0
Anticipated
Actual
5/15
5/22
5/29
6/5
6/12
6/19
6/26
7/3
7/10
7/17
7/24
7/31
8/7



Appendix 11 (continued).